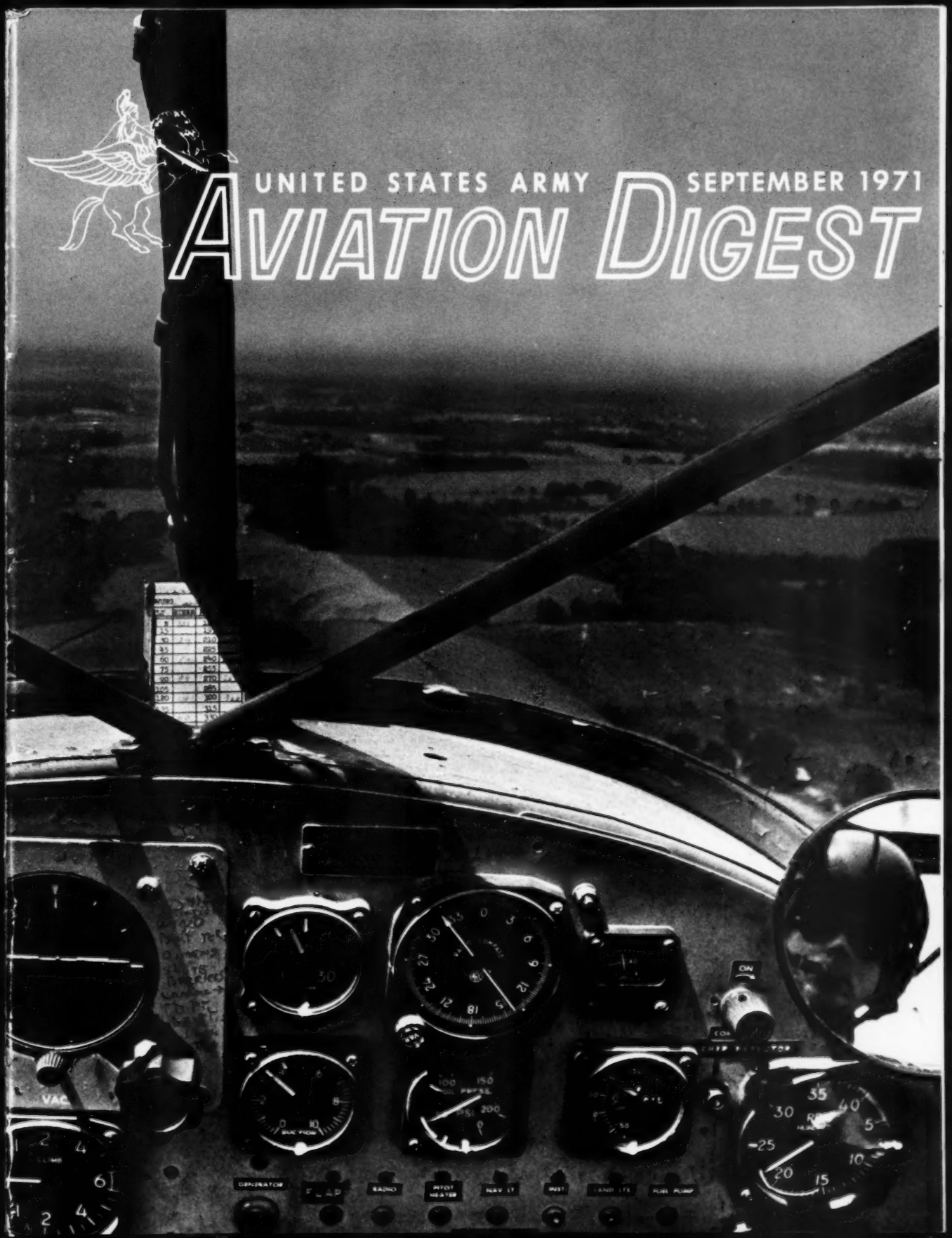
UNITED STATES ARMY
SEPTEMBER 1971
AVIATION DIGEST

UNITED STATES ARMY AVIATION DIGEST

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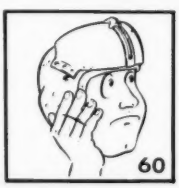

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ABOUT THE COVERS

Army aviation passed a significant milestone recently as the U. S. Army Aviation School at Ft. Rucker, Ala., graduated its last initial entry fixed wing class. Front cover photo by CPT Tom Greene is from the pilot's seat of the old but faithful O-1 Bird Dog. Back cover reflects the "End Of An Era" flyby at the aviation school. A related photo essay starts on page 31

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

The DIGEST is an official Department of the Army periodical published monthly under the supervision of the Commandant, U. S. Army Aviation School. Views expressed herein are not necessarily those of Department of the Army or the U. S. Army Aviation School. Photos are U. S. Army unless otherwise specified. Material may be reprinted provided credit is given to the DIGEST and to the author, unless otherwise indicated.

Articles, photos, and items of interest on Army aviation are invited. Direct communication is authorized to: Editor, U. S. Army Aviation Digest, Fort Rucker, Ala. 36360.

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Soviet Airmobility

Lieutenant Colonel Joe B. Myers

THE SOVIET UNION has not disclosed the use of airmobile divisions such as those employed by the United States in the Republic of Vietnam. However, leading Soviet military thinkers have apparently followed the evolution of the U. S. airmobile concepts and tactics in Vietnam—at least this is indicated by articles that have appeared in Soviet military journals discussing the impact of airmobility on Soviet doctrine.

It is known that the Soviets have conducted some experiments with airmobile concepts and practices. In the fall of 1967 exercises were held in which deep thrusts were made using helicopter assault troops. The operational depths of first-strike objectives were thus increased considerably. Further experiments with this new tactical concept took place during maneuvers the following year.

In the past Soviet emphasis has been primarily on using helicopters as a rear echelon support vehicle rather than in the troop-carrying assault helicopter role. Although some Soviet helicopters are equipped with armament kits, including rocket and machine gun pods, true gunships such as the AH-1G HueyCobra or AH-56A Cheyenne have been missing from the Soviet tactical air fleet, probably because counterinsurgency is not part of its current military doctrine.

The Soviet Union boasts a well-rounded inventory of helicopters that can fill most of its airmobility requirements. These range from light observation aircraft such as the Hare/Mi-1 to the world's largest heavy lift

LTC Myers is with the U. S. Army Foreign Science and Technology Center. **The photo above is of a Soviet Hound Mi-4 with a gun pod supporting East German troops during training exercises**

transport helicopter, Homer/Mi-12.

The Hare/Mi-1 is a light general purpose helicopter equipped with a single main rotor and powered by a reciprocating engine. It accommodates four people and is used for civil and military activities such as observation, ambulance and rescue missions.

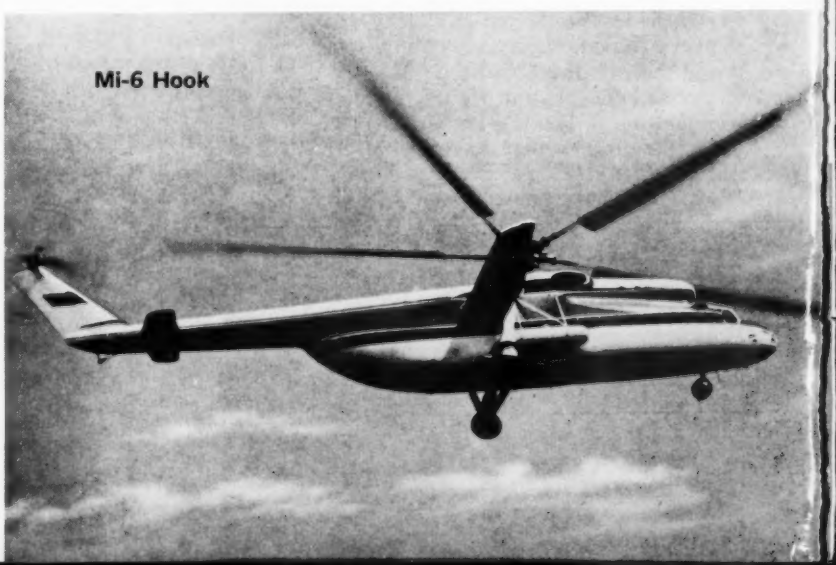
The Hoplite/Mi-2 is basically the same as the Hare but has a twin turbine power plant. It can be equipped for agricultural, transport or passenger service in which case it can carry up to eight people. Currently it is being employed in Soviet military forces and for civil purposes. Hoplite has been seen equipped with external racks for flares or smoke bombs.

The Hound/Mi-4 is a medium lightweight helicopter of conventional design with a four-bladed main rotor and accommodations for 12 to 16 passengers. It has provisions for a flexible machine gun in the forward end of a gondola attached beneath the fuselage. Other equipment includes a rescue winch and hoist. Hound has been standard equipment for many years in the Soviet military and the civil air operations of Aeroflot. It is also widely used in many Communist countries.

The Hook/Mi-6, which was announced in the fall of 1957, is a turbine powered heavy lift helicopter of conventional design and twice the size of any Free World helicopter. Its large fuselage has clamshell rear loading doors including a ramp and can carry several large-wheeled vehicles or 65 passengers. It is also equipped with a cable suspension system for carrying external slingloads and removable stubwings to offload the rotor during cruise. Armament consists of a forward firing 12.7 mm machine gun mounted in the nose. But

Mi-1 Hare

Mi-2 Hoplite



Mi-6 Hook

SU-7 Fitter

Mi-8 Hip

the Soviet Union and many Communist Bloc countries make wide civil and military use of this helicopter and its all-weather capability.

The Hip/Mi-8, which appeared in 1961, is a twin turbine powered helicopter designed to replace the Hound/Mi-4 as a passenger/transport aircraft. The passenger compartment will accommodate 28 fully equipped troops. Hip is used extensively in military and civil operations in many Communist countries.

The Harke/Mi-10 first flew in 1960 and still is the world's largest operational crane-type helicopter. It will carry 28 fully equipped troops and is designed in long-and short-legged variation—one for straddling bulky loads and the other for picking up heavy slingloads. Harke is used by civilians and military.

The Homer/Mi-12, the largest prototype helicopter in the world is currently under development. It has twin rotors and a large transport type fuselage with a rear loading ramp and clamshell doors. Designed with a lateral rotor system, Homer has a high inversely tapered wing supporting two turboshaft engines with a rotor at each wingtip and a tricycle landing gear. Homer is intended as a heavy logistics helicopter for both civil and military operations and is particularly suited as a transfer vehicle for equipment brought in by the large An-22 transports for forward combat areas.

The Soviets also have amassed a broad array of air defense systems to cope with airmobile threats. These systems cover airspace from well forward of the defended ground area to the rear areas.

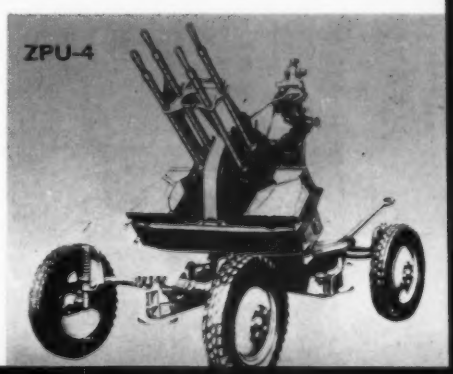
The principal aircraft which might currently be encountered in the forward airspace are the Fishbed (Mig-21) and the Fitter (SU-7). Both are single seat jet fighters. Jet assisted takeoff rockets can be fitted to enable short takeoff runs and both are capable of speeds in excess of Mach 1.5. Armament may include 30 mm cannon rockets and air-to-air missiles (AAMs). These aircraft have successors under development in the Foxbat and Flagon which will be even more powerful and faster.

The Foxbat is reported to have attained record speeds of over 1,800 miles per hour over closed circuit courses. Large numbers of older aircraft such as the Mig-15, Mig-17 and Mig-19 are also available.

Protection against incursions by unfriendly aircraft is provided by a family of surface-to-air missiles (SAMs) which include the SA-3 (Goa), the SA-4 (Ganef) and the SA-6 (Gainful).

Mig-21 Fishbed

Guideline

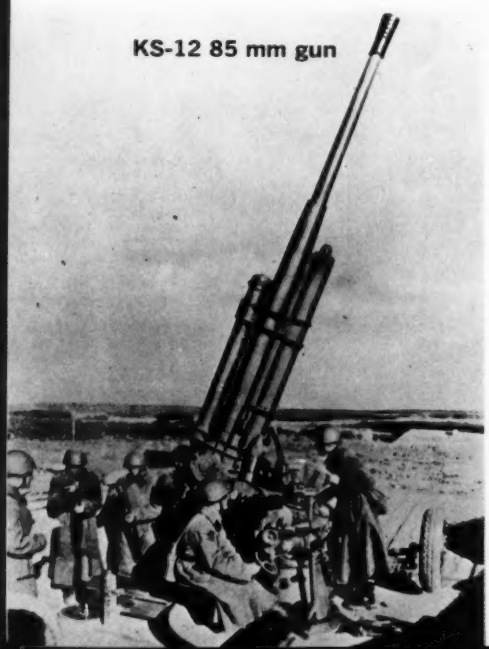


ZPU-4

ZU-23

ZPU-2

M1939 37 mm gun



KS-12 85 mm gun

The basic SAM is the Guideline which had wide deployment during the 1960s including the Warsaw Pact countries (Cuba, Egypt and North Vietnam). The Guideline is the first of the mobile air defense systems. It is transportable on a semitrailer which is towed by a Zil-157 tractor-truck from which it is transferred directly to the launcher, and is a two-stage missile with a solid propellant booster and a liquid propellant sustainer motor. It has radio command guidance. Observation of the performance of the Guideline indicates that it is more effective at higher altitudes than at low level.

The Guideline was followed by the SA-3 (Goa) which appeared in the early 1960s. It is a small solid fuel, two-stage missile with an operational role probably comparable to that of the U. S. Hawk—i.e., low-level air defense. The Goa missiles are carried in pairs on the Zil-157 truck.

The SA-4 (Ganef) was the next member of the family to surface-to-air missiles for the field army and appeared about 1964. It is transported in pairs on an armored tracked vehicle which also serves as the launcher. With four solid propellant boosters and a ramjet sustainer, it has greater range capability than its predecessors.

The newest member of the SAM family is the SA-6 Gainful which appeared in 1967. Apparently comparable to the Hawk, it is about 6 meters in length, has a solid propellant motor and is transported in threes on a tracked transporter-launcher vehicle. Its role is short-range, low-level air defense.

Despite the development of a variety of SAM systems, they have not displaced tube antiaircraft guns in the air defense system of the Soviet ground forces. Rather, the missile and gun systems are complementary. Although only one new caliber antiaircraft gun appeared in the 1960s, some excellent guns which date from the 1950s and 1940s are still in use. This family includes six calibers between 14.5 mm and 100 mm.

The 14.5 mm heavy antiaircraft machine guns are found in two versions, both of which are towed. The ZPU-4 is a quadruple gun system with a mechanical-optical sight and is effective up to about 1,400 meters. The ZPU-2 twin-gun system is virtually identical to the ZPU-4 in operating characteristics.

The newest of the AA guns is the 23 mm towed twin-gun system which appeared in the early 1960s, to be followed later by a self-propelled, four-gun version. It can fire 200 rounds per tube per minute to an antiaircraft range of 2,000 meters.

SA-6 Gainful

7.62 RPK machine gun

RPG-7 grenade launcher

ZSU-23-4 23 mm gun

The 57 mm S-60 is the basic antiaircraft gun of the Soviet ground forces. It has both on-carriage and off-carriage fire control and has an effective range of about 6,000 meters when used in the off-carriage mode with radar and fire control director.

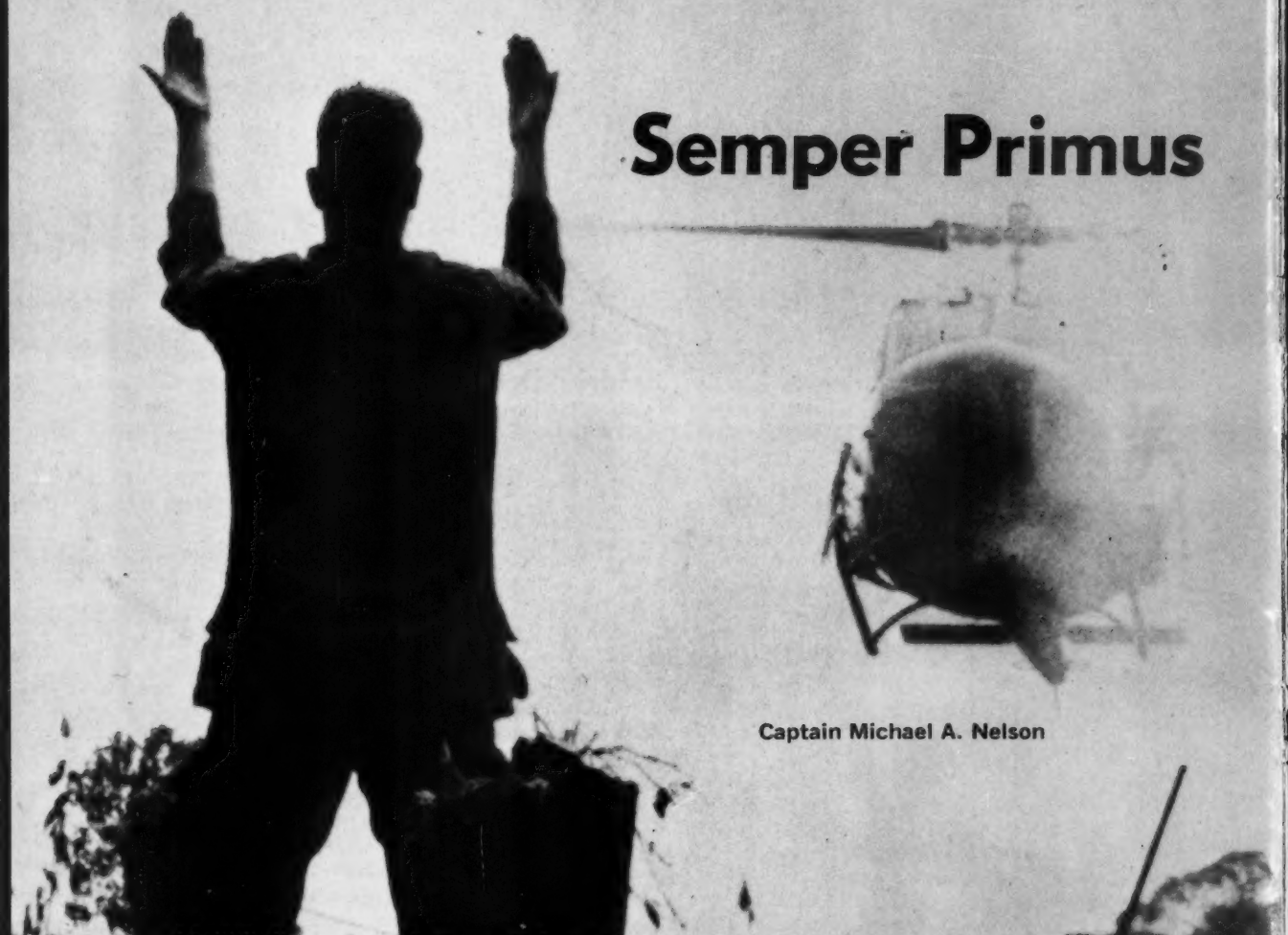
Three older antiaircraft guns, the 37 mm M1939, the 85 mm M1944 and the 100 mm KS-19, are available for use as required by the Warsaw Pact and other countries. Both the 85 and 100 mm guns have off-carriage fire control and the range of these three weapons increases from 3,000 meters for the 37 mm to approximately 8,400 meters for the 85 mm and 13,700 meters for the 100 mm gun.

The 23 and 57 mm guns have self-propelled versions for service with armored units. The ZSU-23-4 self-propelled antiaircraft gun is a four-gun unit which is mounted on a light tracked chassis and carries an onboard radar. The ZSU-57-2 self-propelled system mounts two S-60 guns on a medium tank chassis. It has no off-carriage fire control or radar and a range of about 4,000 meters.

Invading airmobile forces would face antiaircraft fire from weapons other than conventional antiaircraft guns and surface-to-air missiles. The fire of Soviet squad weapons of all types can be brought to bear on slow- and low-flying aircraft flying over defended airspace. These weapons include 7.62 mm assault rifles, machine guns and antitank grenade launchers.

Thus, while the Soviets have not officially revealed much of their airmobile plans the hardware mentioned above clearly reflects a potential for an offensive airmobile capability and a broad range of weapons to offset an airmobile threat.

Semper Primus



Captain Michael A. Nelson

"SEMPER PRIMUS" (always first) is the motto of the pathfinder whose heritage originated in World War II to fill the need of communications and control assistance for airborne operations.

While allied troops stormed the Normandy beachheads, pathfinders paradropped behind enemy lines to mark the drop zones (DZs) for such airborne units as the 101st Airborne Division.

With the conflict in the Republic of Vietnam and the Army's concept of the heliborne assault, the pathfinder again plays an important role in combating aggression; and, with the Vietnamization of the war, aviators today frequently find themselves supporting soldiers who do not even speak a common language. Coordination can sometimes be tough with pathfinders, but without them it is nearly impossible.

Imagine that you have been flying for a Vietnamese battalion for about 3 hours on a morning resupply mission. As is common practice with my unit in Vietnam, when working with allied forces a radio telephone operator (RTO) is aboard from the supported unit. He is your communications link with the unit. Communication with this individual is accomplished through the use of gestures and maybe a sheet of translated phrases. There are places other than the front seat of a helicopter where this type of communication could be better accomplished.

You have just completed your eighth sortie to the field and are on short final to the green smoke at the resupply point. The UH-1H fuel gauge is reading 600 pounds; the trip to the field and back is averaging about 150 pounds; and it takes about 200 pounds to return to your base camp for refueling. One more quick sortie

An 82d Airborne trooper, one of the first dropped in an assault, secures drop zone (DZ) for other paratroopers

can be made with enough fuel left to safely return to the base camp.

The aircraft touches down in the resupply point next to about 1,200 pounds of cargo broken into two loads. The loads control group (LCG) immediately begins to put one of the loads aboard your aircraft while your RTO lays his map on the console and points to a small hilltop within the area of operations (AO).

You nod your head and wave at the LCG to put on the second load. Take both at once, save time and finish this mission; you have other work to do this afternoon.

The RTO shakes his head and waves the LCG off. Using gestures and the map, he explains to you that this is another sortie to go to a different hilltop; take it next time.

Now comes the problem. You explain that there is insufficient fuel for two more sorties. You point at the fuel gauge and at your watch; it is almost time to break for lunch and there will only be one more sortie.

Our allied friend does not understand; he thinks that you are trying to shortchange him. Both of you are short-tempered and have been working long hours with minimum sleep. The climate is miserable and after about 15 minutes of heated discussion both loads are aboard and you are off.

Delivering the two sorties takes a little extra time, but you get the RTO back to the resupply point in one piece. You are homeward bound with 300 pounds of fuel, about 100 pounds reserve. Even though unit SOP says minimum fuel at termination will be 250 pounds you figure "no sweat."

You finally touch down at the refuel site 15 minutes into your 20 minute fuel light. Another successful mission under your belt.

Leaving this hypothetical situation, this question comes to mind: Have you actually been in such a situation or for that matter any situation of similar nature where fuel exhaustion nearly caused disaster? If so, what can be done to prevent such situations from occurring?

By providing each resupply point with aviation liaison personnel the problem will be reduced and overall efficiency increased. How about those pathfinders! They don't have anything to do until next month's big operation. Are they capable of performing this type of mission?

According to the U. S. Army Infantry School's Pathfinders Committee at Ft. Benning, Ga., pathfinder units have the following capabilities:

- Conduct reconnaissance for and selection of landing zones for Army aircraft.
- Move to areas of operations by foot, water or surface vehicle, aircraft or parachute.
- Prepare landing zones to include establishing and operating visual and electronic navigational aids and removal of minor obstacles.
- Assist in the assembly of air-delivered troops, supplies and equipment.
- Provide advice and limited physical assistance in the preparation and positioning of troops, supplies and equipment for air movement.
- Conduct limited CBR monitoring or survey.
- Provide limited weather observation.
- Furnish ground-to-air voice radio communications to aircraft

for the purpose of providing information, guidance and air traffic control within the area of operations.

By using pathfinders in any of these capacities, as well as to assist in the operation of resupply points, dead blade time can be minimized and the aviator can be reasonably assured that the loads will be appropriate to the aircraft and the situation. This will greatly increase the overall capability of each helicopter.

The cost of operating the UH-1 in the Republic of Vietnam has been estimated to be about $50 per flying hour, excluding the cost of the crew. Recovering just one wasted flying hour a day per aircraft in the average aviation company in Vietnam with an availability of 12 slicks per day would be a savings of about $1,200 a day, $36,000 a month or $432,000 a year.

How often are lives lost because sufficient ammunition was not delivered to the field during normal resupply hours? How many times have aviators gotten out of bed to perform emergency resupply after spending an entire day flying resupply into the same area of operations? How many of these pilots and crews are injured or killed flying these tactical emergency missions?

The only way to answer these questions is to fall back on an old cliche: If by changing our procedures we can save one life, it is worthwhile.

By having a man on the ground who understands aviation's capabilities and limitations, the differences that arise can be settled without having helicopters sitting on the ground using up costly aircraft time. When the aircraft arrives at the resupply point, the appropriate load for the aircraft, weather, mission and fuel status could all be ready.

The pathfinder and the aviator know that an aircraft with 1 hour of fuel can lift more than an aircraft with 2½ hours fuel, but how many ground soldiers realize this fact? A pathfinder could ensure that each load does not exceed the maximum safe limits of the aircraft. He understands density altitude and other factors that most nonaviation personnel do not.

During the time that the pathfinder works with the resupply people, he could make them aware of why aviation can do this and why aviation *cannot* do that. When the time comes that the pathfinder is needed elsewhere, a ground soldier who better understands how aviation works will still be around. He will be more cooperative and may even understand why an aircraft can lift 1,500 pounds in the morning but cannot in the afternoon.

Pathfinders are available for the benefit of commanders. Their proper utilization in a combat environment during resupply operations can increase overall efficiency and make more aircraft available for other missions. Let's give that ground commander maximum support by utilizing the pathfinders during all types of heliborne missions.

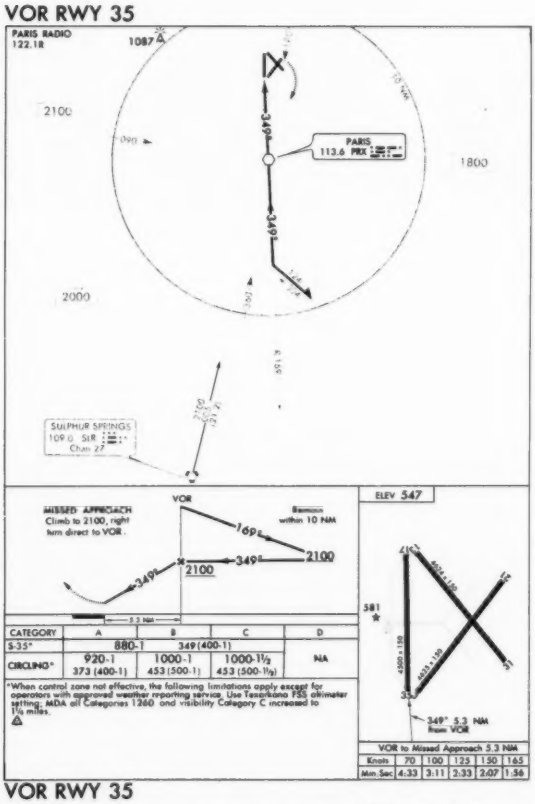
Pathfinders look for a mortar position which fired upon a resupply helicopter approaching their landing zone

INSTRUMENT CORNER

Q. I have noticed that I do not always receive missed approach instructions on a GCA. Why is this?

A. If you plan to land you will be issued a specific missed approach procedure before you start final descent when weather reports indicate that any portion of the final approach will be conducted in IFR conditions. If the final approach is VFR you may not be issued missed approach instructions. If you plan to execute a low approach or touch-and-go the controller will issue appropriate departure instructions to be followed upon completion of the approach. Climb-out instructions will include a specific heading and altitude except when the aircraft will maintain VFR and contact the tower. Reference Terminal Air Traffic Control Handbook 7110-8B, page 167, paragraph 1441 and 1442, dated 1 April 1971.

VOR RWY 35

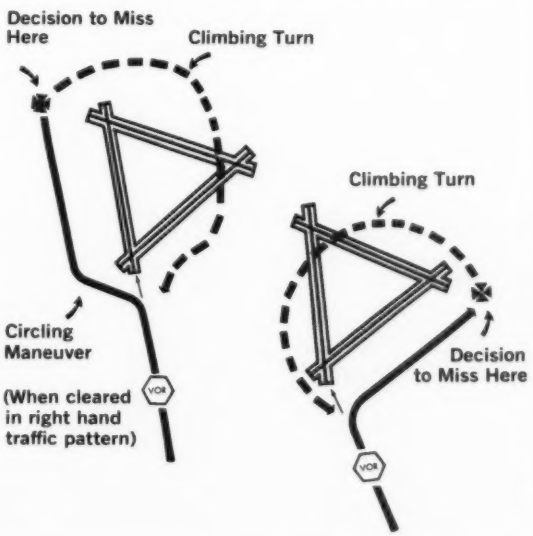


VOR RWY 35

Q. While making a circling approach I encounter IFR conditions again requiring a missed approach. Should I execute a turn as *published* (right or left) to establish myself on the proper missed approach course?

A. No, if visual reference is lost while circling to land from an instrument approach the missed approach specified for that particular procedure must be followed (unless an alternate missed approach procedure is specified by air traffic control). To become established on the prescribed missed approach course, the pilot should make an initial climbing turn toward the landing runway and continue the turn until he is established on the missed approach course. Inasmuch as the circling maneuver may be accomplished in more than one direction, different patterns will be required to become established on the prescribed missed approach course depending on the aircraft position at the time visual reference is lost. Adherence to the procedure illustrated by the following examples will assure that an aircraft will remain within the circling and missed approach obstruction clearance areas. Reference Airman's Information Manual, page 1-65, dated May 1971.

MISSED APPROACH EXAMPLES



The Armed Helicopter Story Part III:

The early work by the Aerial Combat Reconnaissance Company at Ft. Rucker inspired many people and projects began to spring up all over the world. Some experimentors were former ACR Company members; others had seen or heard about "Sky Cav" exercises

ORIGINALLY the Aerial Combat Reconnaissance Company at the U. S. Army Aviation School, Ft. Rucker, Ala., was on its own with little help from outside agencies as it experimented with helicopter weapons systems. Later ACR began to receive assistance. At Ft. Rucker the Combat Developments Office (CDO) and the U. S. Army Aviation Board both provided help.

The CDO was organic to the Aviation School until 1 July 1962 when it became a separate aviation agency of the Combat Developments Command (CDC). The CDC Aviation Agency remained at Ft. Rucker as a Class II activity supporting the development of aviation equipment.

The U. S. Army Aviation Board originally was known as the Army Aviation Test Division and was moved from Ft. Sill, Okla., to Ft. Rucker in October 1954. It evolved through several reorganizations and currently is the U. S. Army Aviation Test Board under the Test Command. There was no formal division within the Board responsible for testing weapons until an Armament Branch was organized in 1961 to test weapons systems for Army aircraft.

On 16 May 1960 the first qualitative materiel requirement (QMR) for an armed helicopter weapons system was approved, and the first systems to reach the Test Board's Armament Branch were the Townsend machine gun fire suppression kit,

Armed Helicopters Around The World

Lieutenant Colonel Charles O. Griminger

the SS-11 wire-guided missile and the Mark XI 20 mm gun in the Hughes MK IV pod.

Meanwhile, the Aviation School's Department of Tactics formed an Armament Division to assist in the training of students in armament subjects and work on the development of armament systems.

The U. S. Army Weapons Command was organized on 1 January 1955 under the Office, Chief of Ordnance. As Colonel Jay D. Vanderpool and his group continued their work, the Ordnance Weapons Command (OWC) lent its maximum assistance. Weapons, ammunition and technical support were furnished for early experiments.

In 1957 the Weapons Command assigned its first Ordnance Corps liaison officer, Captain Robert D. O'Brien, to Ft. Rucker to assist the ACR Company.

In March 1957 the research and development people requested that the Weapons Command implement recommendations of the Deputy Chief of Staff for Operations for development of a single machine gun installation on the OH-13, CH-21 and CH-34 helicopters, and also a four-gun kit for the YH-40 (later designated the UH-1).

Because the helicopter armament program crossed responsibility lines of several agencies, a three-member engineering, steering committee was formed to coordinate and exchange information among the agencies concerned. This committee consisted of a representative from each of the following: Office of the Deputy Chief of Staff for Operations, Chief of Transportation and Chief of Ordnance.

Higher authority had ruled out the development of strictly attack helicopters, and existing aircraft and weapons had to be used. The development of the single flexible machine gun system directed by the Department of the Army began in 1958. The contract for this first funded project was awarded to the Townsend Company and supervised by Springfield Armory. The contract resulted in the Townsend fire suppression kit. Another program was begun with the General Electric Company to install a 40 mm grenade launcher on the CH-34 helicopter. (More information on these systems will be carried in subsequent issues.)

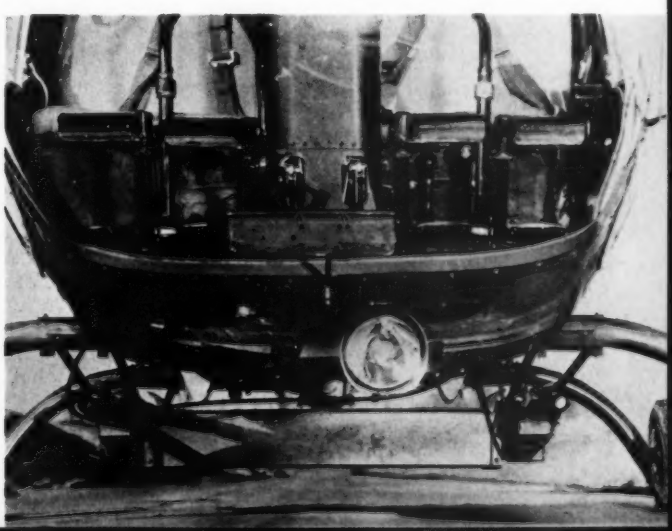
In April 1958 Headquarters, the Ordnance Weapons Command outlined in detail and recommended a series of potential projects in support of Army aviation. Since the OWC had been furnishing liaison officers to Ft. Rucker since 1957, it was acquainted with the projects under development with the ACR Company. The OWC was seeking appropriation of funds to finance work requested in support of projects at Ft. Rucker.

The Office of the Project Manager for Aircraft Weaponization was created in 1962 and placed overall responsibility for helicopter armament under one agency. This occurred during the reorganization of the Army which resulted in the creation of the U. S. Army Materiel Command (AMC) to consolidate functions previously conducted by the separate technical services. The project manager's office was attached to the AMC headquarters in Washington, D. C. Lieutenant Colonel Nelson L. Lindstrand Jr., the first project manager, was charged with responsibility for all aircraft weaponization.

The project manager assumed the responsibility for the already existing XM-1 and XM-1E1 .30 caliber machine gun systems and was instrumental in initiating the procurement of the follow-on XM-2 system. By mid-1963 the project manager's office was well established and coordinating the development of aircraft weaponization. But between 1957 and 1963 numerous helicopter armament programs began to emerge throughout the Army

Photo 1

Members of the Seventh U. S. Army in Europe designed this weapons system mounting two M-37 machine guns between the skids



and helped to build the foundation for today's airmobile concepts.

ACR's tactical exercises involving the armed helicopter initiated the development of the Aerial Reconnaissance and Security Troop (ARST) in January 1960. Army planners were so impressed with ACR concepts that the commanding general, U. S. Continental Army Command, directed the U. S. Army Armor School, Ft. Knox, Ky., to organize an Aerial Reconnaissance and Security Troop. Thus, ARST was formed and patterned after ACR's organization. It also used the weapons systems devised at Ft. Rucker.

ARST was assigned to the 2d Infantry Division at Ft. Benning, Ga., and moved to Ft. Stewart, Ga., for training and testing. Final results of this test proved beyond a shadow of a doubt the requirement for and the feasibility of the air cavalry concept.

ARST was further evaluated in Europe during Exercise "Winter Shield I" in 1960. It became the first air cavalry unit that really had the capability with its aircraft and weapons to perform the traditional armored cavalry mission. With the reorganization of the Army division (ROAD) in 1962, the air cavalry troop was made organic to the divisional armored cavalry squadron.

The Armor School, in conjunction with developing ARST, was responsible for some early weapons experiments and the development of armed helicopter tactics. It conducted armament experiments with the 2.75-inch folding fin aerial rocket (FFAR) and the 4.5-inch rocket mounted on the CH-34 helicopter. Much of this work was accomplished by the 64th Transportation Company. The then Captain Robert Reuter, who was assigned to the Armor School, formalized tactics for the armed helicopter. These tactics were those originally used by the Utility Tactical Transport (UTT) Helicopter Company in the Republic of Vietnam.

Spurred by successful armed helicopter experiments at Ft. Rucker, the commanding general, U. S. Army Europe, directed the commanding general of the Seventh U. S. Army to integrate this capability in certain combat units. The 8th Infantry Division was assigned the mission of developing doctrine, tactics and techniques for employment of armed helicopters on 9 August 1958. Brigadier General Carl I. Hutton, who had been reassigned from the Aviation School at Ft. Rucker, was appointed president of a board to accomplish the assigned task.

Former members of the experimental unit at Ft. Rucker who were assigned to Seventh Army had already begun constructing a weapons system using the M-37C machine gun. This included Captain Harold Hennington, the original Air Cav weapons specialist.

The U. S. Army Ordnance Plant in Mainz, Germany, had been tasked with designing the machine gun system for the OH-13 helicopter. The plant manufactured 30 kits for the OH-13G and 30 kits for the OH-13H. The kits consisted of two .30 caliber M-37 machine guns suspended under the helicopter between the skids (photo 1). The system could be fired either horizontally or elevated 4 degrees to compensate for the helicopter's altitude during hover and forward flight respectively. Elevation, charging and safetying were accomplished manually by the pilot through the use of three levers which could be operated in flight. Fixed sights were attached to the pilot's side of the instrument console.

Weapons kits were issued to each armored and infantry divi-

Photo 2

The world's most heavily armed helicopter made its appearance at Ft. Benning, Ga., in 1957

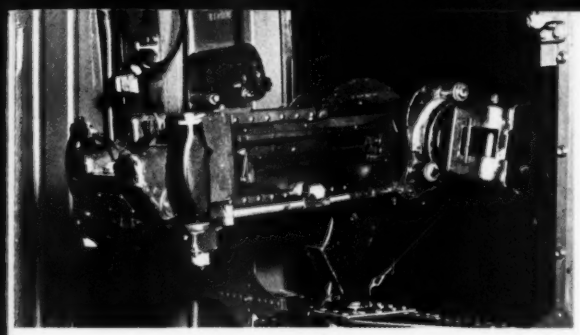


Photo 3

This .50 caliber machine gun was installed in the cargo door of the world's most heavily armed helicopter, a CH-34 Choctaw, at Ft. Benning, Ga.

sion in Seventh Army. Instructor pilots for these divisions were trained by the 8th Infantry Division Board. To aid the board in its evaluations an exercise was conducted at Grafenwohr, Germany, on 17 February 1959.

The Seventh Army kit was tested during the period 20 August 1959 to December 1959 by the Springfield Armory. During this period it was modified and retested and found to be satisfactory except for certain discrepancies including a high carbon monoxide contamination when firing, minimum elevation capability and no azimuth traverse capability.

In July 1957 another general interested in the armament of helicopters assigned a mission which led to the development of the world's most heavily armed helicopter. General Herbert B. Powell, impressed by Ft. Rucker's work with armed helicopters, asked Major William A. Howell to conduct some experimentation in helicopter armament. GEN Powell was the commander of the U. S. Army Infantry School and Center at Ft. Benning and MAJ Howell was executive officer of the Lawson Army Airfield Command.

GEN Powell, an Army aviator, was interested in helicopter-borne operations for infantry units. He realized the need for helicopters to have a suppressive fire capability during assault landings. With this concept in mind, MAJ Howell on 29 July 1957 appointed CWO James E. Ervin Jr. as his project officer. CWO Michael J. Madden and Specialists Elmer MacDonaldson and Charlie Brown were assigned to assist him. Their first step was to coordinate with the ACR Company at Ft. Rucker for information and materials.

Having obtained machine guns and equipment at Ft. Rucker, work began on arming a CH-34 helicopter (number 34493).

By 5 August 1963 CWO Jack Brown and Specialist Davis were detailed to help with the armament project. CWO Ervin began visiting Air Force and Navy installations in order to obtain intervalometers, weapons and associated equipment. Large amounts of equipment were required as the overall plan was to arm five cargo and twelve reconnaissance helicopters.

By 30 September Sikorsky Aircraft had sent representatives to assist Ft. Benning on the project. The result was the world's most heavily armed helicopter. This CH-34 (photo 2) was armed with two AN-M220 mm machine guns, two .50 caliber AN-M2 aerial machine guns, four .30 caliber AN-M2 aerial machine guns, two pods of twenty 2.75-inch FFAR each, two 5-inch high velocity aerial rockets (HVAR), two additional .30 caliber machine guns in the left side aft windows and one .50 caliber machine gun in the cargo door. Photo 3 shows the cargo door installation of the .50 caliber machine gun.

On 2 October 1957 Ft. Benning's heavily armed CH-34 was sent to the Sikorsky plant for modification. It was returned to Ft. Benning and test fired on 9 October.

The CH-34's sighting systems proved to be inaccurate and the 5-inch HVARs were dangerously erratic. These errors were corrected and a satisfactory firing was conducted before the Joint Civilian Operations Conference (JCOC) on 11 October except for 20 mm cannon muzzle blast damage to the air intake duct of the helicopter. The fire wall was badly cracked from vibrations. The experimentors at Ft. Benning had also been arming OH-23 helicopters and conducted a successful .30 caliber machine gun firing on 5 November 1957.

The experiments at Ft. Benning came to an end early in January 1958 due to the lack of command support and sufficient weapons to complete the project. The CH-34 helicopter was transferred to Ft. Rucker where additional experiments were conducted with the system.

The Air Cavalry Troop, Troop "D" of the 1st Armored Division's Cavalry Squadron, also conducted early helicopter armament experiments. Much of the credit for this early work belongs to Major General Ralph E. Haines Jr., the division commander, and Lieutenant Colonel John C. Hughes, who commanded the division's 501st Aviation Battalion.

The Air Cavalry came into existence when the 1st Armored Division was organized under the ROAD concept in February 1962. During its first year of organization the Air Cav Troop experimented with several helicopter weapons systems. The "Old Ironsides" machine gun kit (photo 4), a twin .30 caliber system, was mounted on the OH-13 helicopter. Twin .30 caliber machine guns (photo 5) were installed on the battalion's troop-carrying UH-1B helicopters. This system had a flexible mount

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Provided by the Society of U. S. Army Flight Surgeons

Aeromedical Evaluation —A Philosophy

Lieutenant Colonel John D. Albright, M. D.

Have you ever wondered about the reasons for the strict physical standards aviation personnel must meet? In this article the author explains why flight surgeons consider physical standards so important and how they approach interpretating them

FOR AT LEAST 21 centuries the practice of medicine has revolved around one central undeniable ethical obligation of the physician. His actions must, in his considered judgment, be directed toward the best interests of his patient. Physicians who practice aviation medicine bear this responsibility no less than their colleagues in other areas of medicine. The specialty of aviation medicine, however, confronts the physician with an additional moral obligation seldom encountered so dramatically by physicians in other fields. He must, while pursuing the best interests of his patient, assure himself that the patient's predictable actions will not harm society in general as a result of his flying activity.

Aeromedical evaluation is the process of examining medical information in light of the unusual performance demands placed upon an individual in the aviation environment. Such evaluations are made under two somewhat different circumstances. The first involves selection of individuals for flight training. Here the method is to select those likely to fly for a long time in order to offset the high costs of training. In essence, there is an attempt to "buy" the best long-term investment risks that the market (i.e., number of applicants versus number of positions to fill) will bear. On the other hand, when a fully trained professional aviator is evaluated the primary concern then is to obtain the maximum return for the investment at minimum risk.

This distinction in approach between selection and retention applies only to the military services and to commercial enterprises employing aviators. The Office of Aviation Medicine of the Federal Aviation Administration (FAA) concerns itself only with flight safety considerations.

The remainder of this discussion devotes itself to aeromedical evaluation of trained aviators. The exploration of the philosophical aspects of selection will not be attempted here, nor will the legal, administrative and political problems of the implementation of aeromedical decisions.

Flight medical standards of the military services and the FAA provide legal and administrative guidance (based on an empirical or "lessons learned" approach) for physicians who must make aeromedical decisions regarding evaluation of flying personnel. Experienced flight surgeons realize that these regulations may fail to provide adequate guidance in marginal situations. Some of these standards may be waived by proper authority under certain circumstances. Evaluation, in depth, of aviation personnel is often performed by a variety of clinical specialists, but the flight surgeon retains the responsibility of interpretating the significance of the medical findings in relation to the aviation environment. He cannot delegate responsibility for the ultimate decision regarding medical fitness for flying to any other specialty.

Aeromedical disposition, whether the case is simple or complex, ultimately involves answering two basic questions:

- Does the state of the patient's physical or emotional health create a hazard to flying safety?
- Does the flying environment create a hazard to the patient's physical or emotional health?

These questions are deceptively simple. As in many other basic medical questions, especially those dealing with predictive medicine, the process of answering them is most difficult. It involves the evaluation and integration of decidedly different information, both of a general and specific nature, derived from factual, empirical, clinical, statistical, epidemiological* and intuitive sources. Since this is essentially a judgmental process, equally competent physicians occasionally will disagree when evaluating identical information. Medicine is not a mathematically precise science. Such conflicts occasionally are unavoidable and must be resolved by the senior flight surgeon concerned.

In respect to the first question, it must be determined if the patient's condition is likely to interfere with his ability to safely perform flying tasks under any reasonably foreseeable circumstances. (The determination of his flying skill, per se, is not fortunately a medical responsibility; the flight surgeon is asked to predict only his *potential* ability to fly safely.) Specifically, it must be determined that the individual undergoing evaluation has no detectable physical or emotional conditions which might potentially interfere with his ability to perform his flying duties.

In dealing with the marginal individual, expert clinical consultation must be obtained, if necessary, to define within the limits of medical knowledge and current diagnostic methods the *full* physiologic and/or psychologic aspects of the individual's health status. The responsibility of the flight surgeon then is to evaluate the implications of this medical information in relation to the demands and hazards of the flying environment.

***Epidemiology is the study of the distribution (e.g., old, young, male, female, thin, fat, etc.) and dynamics (method of spread, influence of environmental factors, etc.) of disease.**

When all aspects of an evaluation have been exhausted and the case is still obscure, the aeromedical disposition cannot be deferred. This is the moment of truth. The principle of absolute fairness to the patient must be tempered with the reality that no compromise with flight safety can consciously be made. It is true that these decisions do not have the dramatic impact of those obviously vital life and death decisions made by the operative surgeon. But, is the loss of many lives in an avoidable aircraft accident any less tragic than the loss of a similar number of lives in an epidemic? Is the loss of a grounded pilot's only occupation less threatening to him than the loss of an arm or leg?

Once it has been determined that the state of the pilot's physical and emotional health does not create a predictable hazard to flight safety, the second question—which is usually less perplexing than the first—can be considered. Obviously, flying is a dangerous occupation though not nearly as perilous as is generally assumed. The approach, as in the first question, is one of relative judgment. The practice of aviation medicine seldom deals in absolutes. Does the exposure to the aviation environment create a greater risk for the individual in question than for the population from which he comes (i.e., pilots of his category in general)?

A wide variety of medical conditions can be adversely affected by the hostile aviation environment. Further, conditions not directly aggravated by the environment may require medications or treatment not compatible with flying. It is felt that therapeutic decisions should be

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Charlie and Danny's Write-In

Dear Danny: During a recent CH-54B flight we had our ASH-19 circuit breaker pulled and upon landing we had no brakes. Why Danny?

W. L. S.

Danny's answer: It has been called to our attention that there have been occasions when the ASH-19 circuit breaker has been pulled in flight to shut off the ASH-19 system. Should this breaker be pulled or "pop" due to a circuit overload condition, the hoist isolation valve will become disabled.

The background and ramifications on the above statement are explained as follows:

- **The hoist isolation valve is located on forward inboard side of left hydraulic panel. When the helicopter is on the ground the isolation valve remains open as verified by the ISOLATION VALVE OPEN light on the caution advisory panel.**
- **Control of this valve while on the ground is obtained through the closed contacts B1 and B2 of energized relay K161 and/or the isolation valve control switch. Coil power for relay K161 is provided by the No. 2 DE PRI bus through the ASH-19 control circuit breaker in conjunction with the left-hand landing gear scissors switch (closed by weight of aircraft on wheels).**
- **During flight the HOIST ISOLATION CONTROL switch is normally closed. When transporting a load on the load levelers, the remote control switch on the aft pilot's four-point LEVELER control panel, or the WALK AROUND CONTROL switch (helicopters S/N 70-18485 and subsequent) on the aft pilot's four-point JETTISON panel, allow hydraulic pressure, assist to hold the load and allow for hydraulic shock absorber action of load leveler servocylinders when placed in the ARMED position. The isolation valve opens automatically for inflight engine start and hoist operation.**
- **Should the ASH-19 circuit breaker be pulled or become disengaged, upon landing the isolation valve remains closed as evidenced by the ISOLATION VALVE OPEN light not illuminating. This results in complete loss of power boost for the pilot's and copilot's brakes which receive hydraulic power from the utility hydraulic pump from the isolation valve.**
- **As an alternate the hoist isolation control switch located on the hoist isolation control panel on the center console may be turned on to operate the isolation valve.**

In view of the above, we recommend that the ASH-19 circuit breaker not be pulled in flight as a means of disabling the ASH-19 system. This system was purposely designed so that it could not be shut off in flight. However, if it is deemed absolutely necessary for the system to be shut off in flight, it is required that the circuit breaker be reengaged or that the HOIST ISOLATION CONTROL switch be closed in order that power boost for the brakes be available upon landing.

Dear Danny: I call your attention to the U-8D dash 10 (TM 55-1510-201-10/4, page 10-5, paragraph 10-45) which says in essence that, "Just prior to takeoff you should adjust the carburetor heat handles in accordance with the following chart." Well, this is probably good information to know, but where is the chart?

CPT C. W. L.

Danny's answer: I agree, captain, that the referenced chart would probably be real handy, but the sad part of this story is the chart doesn't exist. In the meantime I suggest you turn to page 3-10, paragraph 3-30, c, note, and follow the procedure as outlined. A correction to the manual has been submitted.

Dear Danny: I do not completely understand how a turbine engine, specifically a Lycoming T53-L-13, can develop more than 100 percent N1 speed. I would think that the engine would be calibrated to read 100 percent as maximum N1 rpm.

CPT G. A. H.

Danny's answer: To answer your question we have contacted the experts at Lycoming, namely Mr. A. E. Wagher, chief, Field Engineering Service Department, and here is his reply:

"Military turbine engines are designed in accordance with specification MIL-E-8593. All deviation

from MIL-E-8593 are defined in the individual engine model specification by the manufacturer and are approved by the military at the time of engine qualification acceptance.

"Military specification AND20005, which controls design configuration of engine accessory drives, requires a tachometer indication of 100 percent with a drive input of 4200 rpm at the maximum rated engine speed. The T53 series engines have an accessory drive ratio of .1670:1. This ratio provides a tachometer indication of 100 percent at 25,150 rpm. On the T53-L-13 series engines this rpm is below the maximum rated speed of 101.5 percent at 25,600 rpm and, therefore, a deviation to AND20005 is reflected in the engine model specification. This deviation deletes the necessity of a variable accessory drive gear ratio which would be required to standardize power ratings at 100 percent in accordance with the military specification.

"The majority of T53-L-13 fleet will develop minimum guaranteed power below 100 percent N1 speeds. During an engine's life span components may be replaced which will alter the engine's original rated speed. In order to provide the operator with a means of determining and obtaining desired power, following component replacement, Lycoming instituted the trim to torque procedure currently in field use. However, when trimming to torque, maximum engine parameters of speed, torque and EGT should never be exceeded."

IT HAD BEGUN TO drizzle, in fact the weather had been lousy all day. It was like many of those October days in Southern Bavaria, the ceiling had been running from 2,000 to 3,000 feet with visibility down to a mile.

It had been an interesting day. We were in support of Company A, an infantry unit we thoroughly enjoyed supporting. Earlier in the day at 1000 hours we had made an insertion near the base of the Bavarian Alps. The mission was a company size recon exercise which would terminate approximately 10 miles to the west of the insertion. Our flight of 10 CH-34 Choctaws was scheduled to extract Company A at about 1600 hours and return it to its base camp near Bad Tolz, Germany.

It was 1600 hours when our flight leader started his approach to a large field in a remote area designated as the pickup zone. Since there were no troops in

We didn't realize until the next morning that we had shot our approaches over some 200-foot steel towers supporting high-tension lines

Major James R. Hensley

sight our flight leader instructed us to shut the aircraft down to conserve fuel for the return trip. It was quite a comfortable feeling as the aircraft gave us protection from the elements and was still warm from its flight to this position. Very soon the troops should be arriving and we would have about 30 minutes of flying time back to the base camp and some warm chow.

At 1630 hours there was no word from Company A. By this time the warmth of the cabin had escaped and the cool, damp weather had begun to penetrate the depths of our flight clothing.

It was approaching 1645 hours when the brigade aviation officer landed his OH-13 at our position. He informed our flight leader that the terrain had been more difficult than anticipated which accounted for the troops late arrival. He said that the unit was pushing as hard as possible and should arrive at our position no later than 1730 hours.

We didn't mind the wait as we knew the men in Company A were depending on our helicopters to return them to base.

By 1700 the weather began to deteriorate, the hills to the south of our position obscured; the visibility must have been down to a mile.

It was apparent that a decision must be made at this point. There was no doubt about the qualification of our leaders; we had some of aviation's best as members of the flight. It was determined that alternate transportation for Company A was over 4 hours away by road and then it would take most of the night to get the troops back to their base camp using vehicles.

The aviation liaison officer reported that the troops should be at our position in a matter of 25 to 30 minutes. This would still allow sufficient time to get back to Bad Tolz during daylight hours. Crew qualifications were of no great concern as the average cargo time in the unit was 1700 hours per pilot, most of whom had been qualified in the CH-34 more than 3 years. After all we were doing this for Company A, which had been pushing extra hard for the past 2 hours knowing it was behind schedule.

The decision was made to stick it out a little longer. At 1730 the first platoon of Company A was in sight. We couldn't leave now although we knew every minute we waited was a minute of darkness we would encounter on the return trip.

It was after 1800 hours when the final element reached our position. By this time darkness had reduced visibility even more. It was about 30 minutes after dark when the last infantryman boarded the last aircraft. Our crew chief called out, "Full load, sir." This meant 12 combat-loaded troops which was no problem as our fuel load was over half exhausted.

I climbed into the copilot's seat as my stick buddy had completed the instrument qualification course a couple of months before and I wanted to take every advantage of an already poor situation. In a few minutes our rotors were turning, a nice blue flame from our exhaust illuminated the ground outside my window. The flight leader was calling for a commo check; we answered Chalk No. 4 up as our turn came.

A couple of minutes later I saw our leader switch his Grimes light on which was his signal that he was ready to depart. Due to the low visibility a trail formation was selected as best for the flight to Bad Tolz.

A large blue flame from the exhaust of the lead aircraft indicated that he was lifting off; he was followed immediately by Chalk No. 2 and No. 3. We lifted off behind No. 3 and tried to maintain as close an interval as possible since the three aircraft ahead were the only visible things we saw outside the aircraft. As we initiated our climb Chalk No. 1 and No. 2 had disappeared into the poor visibility and our concern grew greatly. Chalk No. 3's lights began to look fuzzy as we increased our power and moved in a little closer. At this time the flight leader was heard to transmit, "Weather is very poor, if you haven't departed hold your position."

Chalk No. 9 and No. 10 were heard to answer, "Roger, Chalk 9 and 10 holding on the ground."

Everything below was one big black mass. Since we knew the mountain ranges were to the south, we decided to climb out

on a northeast heading and then east to the Bad Tolz Army Airfield. It was felt this route should keep us clear of mountain ranges at an altitude that would keep us out of the clouds.

At 2,500 feet we were in the base of the clouds. Chalk No. 3 called descending to 2,000 feet and we followed. We had launched eight of the 10 CH-34s and in no case were there more than two aircraft in visual contact with one another.

Headings were varied by the individual groups to maintain some kind of separation. About 12 minutes after takeoff we hit a solid wall of weather. Chalk No. 3 called entering a left turn. We followed suit using one-half standard rate of turn to avoid No. 3's flight path. Coming out of instrument conditions we spotted a glimmer of light from Chalk No. 3. We picked up a heading of north and flew for 2 or 3 minutes hoping that the weather conditions would improve.

The radio frequency was pretty cluttered with the flights talking to each other and discussing individual situations. A couple of more minutes elapsed when we noticed that we were coming up on an area where there seemed to be some kind of illumination from below. It was quite possible that we were over one of the small towns in the area. In any case it was the first indication since our takeoff that there was anything below and we didn't want to give it up.

Chalk No. 3 set up a shallow orbit to the left and we followed. We continued to orbit for 4 to 5 minutes while we sized up our situation. We realized that due to the weather it was impossible for us to continue to Bad Tolz as a flight of two. Our aircraft had an inoperative ADF so an IFR flight to Bad Tolz was out of the question. We decided against a radar approach to Munich since we were below reception altitude and our fuel situation would run dangerously low flying to Munich. After coordinating with Chalk No. 3 we decided that the only alternative was to attempt a landing.

Using what appeared to be a light in the haze and fog below, we started a slow descent while maintaining the orbit. Once we were low enough to be sure that the illumination below was indeed a small town, Chalk No. 3 decided that he would make the first attempt to land. His final approach was made keeping the illuminated area to his front.

A few minutes later—which seemed like hours—No. 3 transmitted that he was on the ground and hovering to an area away from some power lines to set down. It was some relief to know that No. 3 had made it. After carefully planning our approach and discussing the details, we decided that it was time to try our skill in executing such an unconventional approach. We rolled out on final approach with the illuminated area as forward as visibility would permit. My stick buddy decided that he would remain on the gauges and maintain a 500 foot-per-minute rate of descent.

The search light was turned on as we passed through what we thought to be 500 or 600 feet altitude. I was certainly glad that my stick buddy was on the gauges as everything outside was white. I slid my window open to increase my visibility. With my head out the window I began to pick up objects below at about 100 feet. It appeared that we were over a dense forest. Calling on the Choctaw for all available power, we came to a hover about 25 feet above the trees. By this time Chalk No. 3 had observed our position and directed us to an open area to our left. I glanced at my watch and noticed that we had been in the air for only 35 minutes. Four hundred pounds of fuel remained unused as we shut the engine down.

After a short walk to the village we called our position and downtime to company operations at Bad Tolz. We were informed by the operations officer that four of the aircraft had made it to the Bad Tolz Army Airfield with the use of ADF for navigation and approaches. Two other aircraft had made approaches similar to ours to a position about 10 miles from us, and, of course, the wisest were Chalk 9 and 10 who were still on the ground at the point of departure. Little did we realize until the next morning that we had shot our approaches over some 200-foot steel towers supporting high-tension lines.

I think one of the biggest mistakes we made was not following the dictates of our own good judgment. Certainly prior planning for an alternate method of recovering the troops had a great bearing on the final decision to attempt the mission. I believe that in many cases situations with similar circumstances exist today. It is the true spirit of every aviation unit to accomplish the requirements of the supported unit. Just those few minutes we waited for Company A might as well have been hours because the weather was not suitable for VFR night flight. From the time of takeoff the flight was doomed to failure. Increased instrument qualification in recent years has prepared Army aviators to cope with situations such as this flight, but no amount of training will ever take the place of following *good judgment and common sense.*

Armed Helicopters Around The World

Continued from page 13

and recoil absorption devices. The guns were pneumatically charged, electrically operated, could be elevated 15 degrees and carried 700 rounds of ammunition for each gun.

The troop also designed and built .50 caliber M-2 and M-3 kits for the UH-1B helicopter and the Womack kit (photo 6), designed by the division's CWO Clemuel H. Womack, which included twin .30 caliber machine guns and two 2.75-inch FFAR launcher pods of 24 rockets each.

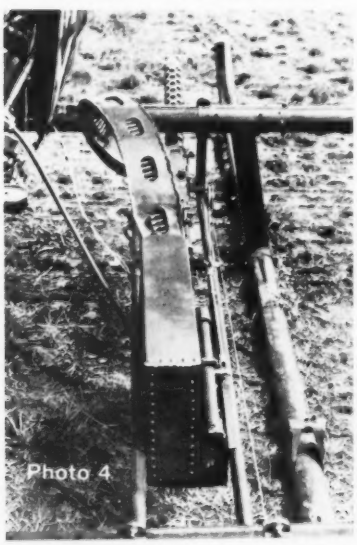
The United States' first armed helicopter company was activated in Okinawa on 25 July 1962. Its original mission was to provide troop transport. This unit, the Utility Tactical Transport Helicopter Company was deployed to the Republic of Vietnam in October 1962 under the command of the late LTC Robert Runkle. It spent considerable time in Thailand readying for combat, then arrived in Vietnam on 9 October and received its baptism of fire 7 days after that.

Command of the UTT was assumed by Major Ivan Slavich on 21 November 1962.

The UTT Helicopter Company was given the mission of providing armed escort for troop-carrying helicopters. Experience had proved that a fire suppression capability other than that of just door guns was required. The troop-carrying helicopters, although mounting door guns, were too vulnerable to enemy ground fire when loading and unloading troops.

Early work on armament systems for the UTT helicopter can be traced to January 1962 and

"Old Ironsides" (below), a twin .30 caliber machine gun system, was tested by the 1st Armored Division under the ROAD division in 1962. Flexible .30 caliber machine guns (right) were also mounted on the 1st Armored Division's troop-carrying UH-1B Huey helicopters. The 2.75-inch FFAR launcher pods (below right) were later added to the Womack kit pictured here



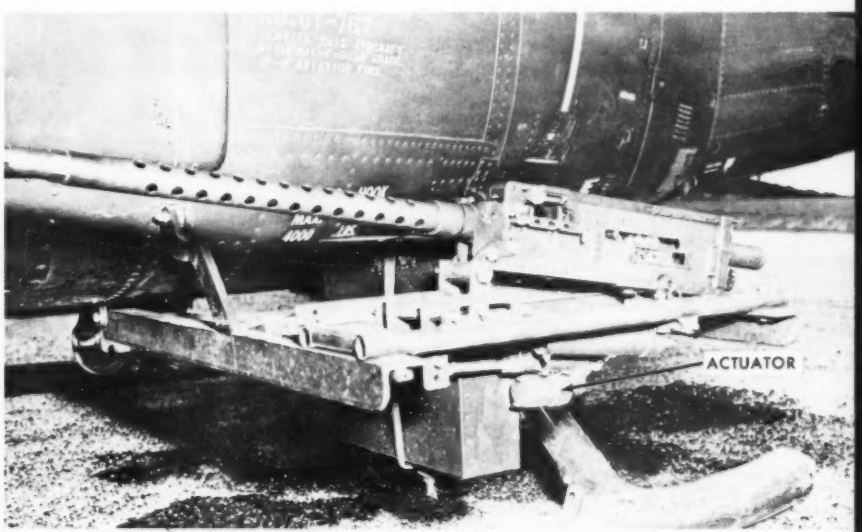
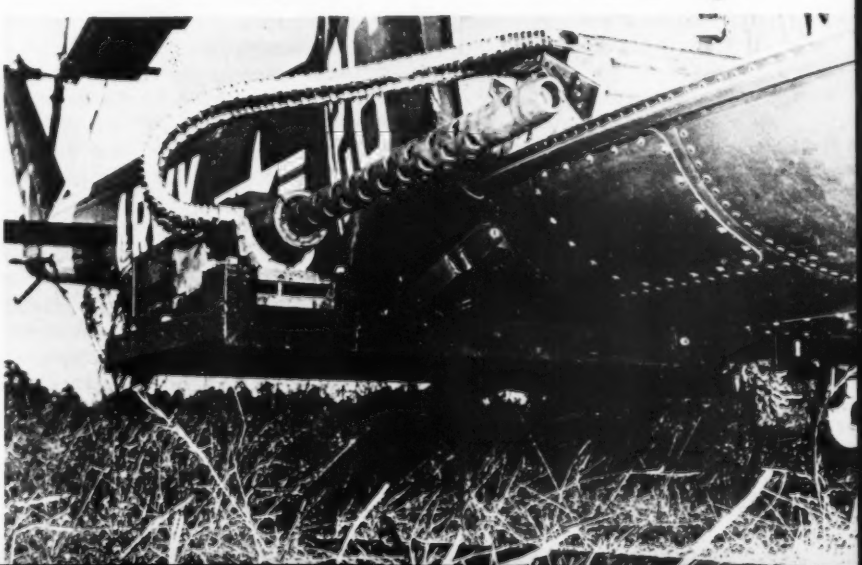


Photo 5 ⬆ ⬇ Photo 6



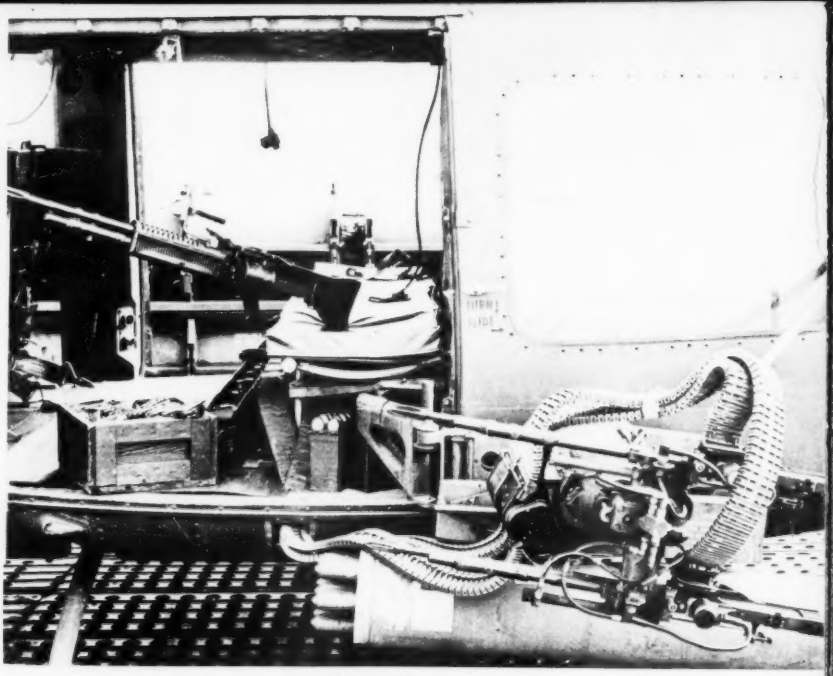


Photo 7

Elastic bungee cords suspended from the ceiling of the aircraft are used in many gunships which don't mount door guns

CWO Clarence J. Carter in Okinawa. CWO Carter had been an armament officer for the ACR Company at Ft. Rucker and was summoned to Okinawa by Major General Normando A. Costello, G-3, U. S. Army Pacific. GEN Costello wanted CWO Carter to arm some helicopters for an exercise to be conducted in February 1962.

CWO Carter was able to develop a skid-mounted AN-M2 aerial machine gun system for the UH-1B which overcame a previous problem of destructive harmonic vibrations in the airframe. CWO Carter also developed a 2.75-inch FFAR system for the UH-19. These jury rigs were the beginnings of the armament systems of the UTT Helicopter Company.

The UTT Helicopter Company did a great deal of experimentation in the development of door guns for helicopters according to Major Robert L. Webster Jr., an early member of the unit. Early experiments included the use of automatic carbines, M-14 rifles and M-16 rifles scrounged from Special Forces units. Later the M-60 machine gun was tried. These shoulder fired weapons all proved to be ineffective when fired from a maneuvering helicopter. Later, in an effort to stabilize the weapons, they were suspended with elastic cord from the cabin ceiling. This system proved to be more effective and is used in gunships which normally don't mount door guns (photo 7).

With its arrival in Vietnam the UTT continued its experimentation on the development of larger weapons. Photo 8 shows a 2.75-inch FFAR system devised by Major Luther Lollar and CWO Cleatus Heck in 1963.

CWO Womack (who had been with the 1st Armored Division) was responsible for several weapons innovations in the UTT Helicopter Company. He was responsible for a 2.75-inch FFAR launcher which he adapted for use on the UH-1 helicopter. The idea behind this system was to reduce the drag on the aircraft created by the open-faced launchers. CWO Womack also developed a smoke tank which became known as the E39RI.

With the delivery of the M-6 quad machine gun to the UTT Helicopter Company, CWO Womack began work in 1963 on what became the forerunner of the M-16 (photo 9). He adapted a seven-tube LAU32/A 2.75-inch FFAR pod to the M-6 system giving it a multiweapon capability.

The UTT Helicopter Company received a great deal of support in these experiments from the late Brigadier General Joseph Stillwell Jr., the Support Command commander in Vietnam, and Captain Carl Davis of the Support Command's Ordnance Section.

Throughout 1963 the UTT Helicopter Company served as a test unit to determine the effectiveness of armed helicopters. The unit developed such tactics as the "Eagle Flight," which was first used in April 1963. The Eagle Flight was designed to provide an onstation helicopter-borne combat force escorted by armed helicopters that could be placed into an objective area on short notice. The armed helicopter concept worked so well that by June 1963 four other helicopter companies received armament. UTT Helicopter Company personnel assisted these units with weapons systems installation and training.

Eventually the UTT was redesignated the 68th Aviation Company, later the 197th Aviation Company and then the 334th Aviation Company (Escort). On 26 April 1965 it became the first Army unit in Vietnam to receive the Distinguished Unit Citation.

By December 1957 Major General Hamilton H. Howze, Director of Army Aviation, was

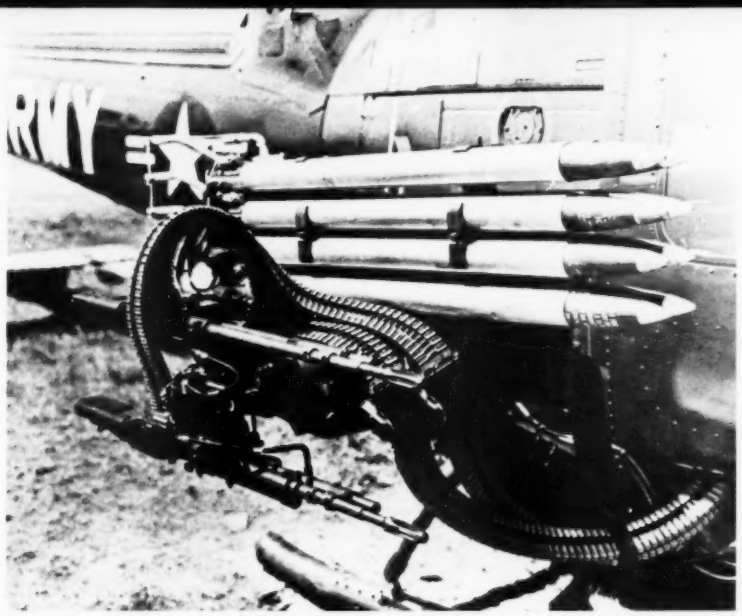


Photo 8

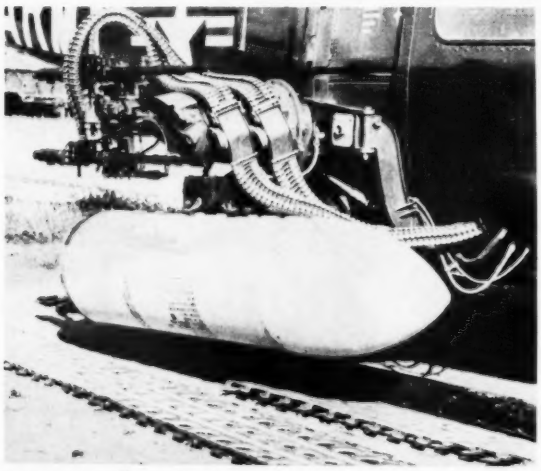


Photo 9

Members of the UTT devised the 2.75-inch FFAR system (above) as well as the weapons system to the left which was one forerunner of the M-16 kit

recommending that an experimental air cavalry unit be created. In August 1962 the Howze Board completed a study on airmobility concepts. The board was officially titled the Army Tactical Mobility Requirements Board. It recommended helicopter armament systems and a greater degree of tactical airmobility for the Army ground forces and laid the foundation for the 11th Air Assault Division (Test). The 11th Air Assault became the 1st Cavalry Division (Airmobile), which later deployed to the Republic of Vietnam.

The development of the airmobility concept required a responsive artillery weapons system. Consequently, studies were initiated at the U. S. Army Artillery and Missile Center, Ft. Sill, Okla., in January 1963 to evaluate possible systems for the airmobile mission.

In March 1963 the Committee for Aerial Artillery Test and Evaluation (CAATE) was formed. The first system tested was a CH-34 helicopter mounting one 10-tube, 4.5-inch rocket pod on each side (photo 10). The system was first fired in May 1963 and placed on line with artillery pieces to participate in Ft. Sill's famous firepower exercise.

One CH-34 could deliver the same firepower as one volley from a battalion of 105 mm howitzers. An interesting sidelight to these tests was the testing of 105 mm weapons fired from the cargo doors of the CH-34 and UH-1 helicopters by this artillery board and Rock Island Arsenal, Ill.

The first Aerial Artillery Battery (Provisional) was organized in May 1963. The Aerial Artillery Battery tests were originally planned to use UH-1Bs equipped with the XM-3 system. But, the system wasn't available and the CH-34 with the 4.5-inch rockets was used instead.

The U. S. Marine Corps did much of the early experimentation with armed helicopters but were hampered by the lack of funds. In an effort to conserve money the Marines conducted some joint experiments with the Army. Photo 13 shows a Marine HOK-1 (OH-43) helicopter armed with the SS-11 (now M-22) missile around the year 1959. In June 1960 the Marine Corps experimented with a CH-34 helicopter armed with the Navy's Bullpup missile mounted on one side and a twin 20 mm gun pod mounted on the other (photo 11). The firing of the Bullpup missile on a Chesapeake Bay range was the largest and first radio-controlled missile fired from a helicopter.

Although the Marine Corps conducted early armed helicopter experiments, its commandant didn't authorize armed helicopters for the Marine Corps until 31 December 1964. The Marines first employed armed helicopters in the Republic of Vietnam in April 1965.

The SH-3A helicopter was produced by Sikorsky in 1959 as a completely integrated weapons system for the U. S. Navy. It was to be used to detect and destroy enemy submarines. The

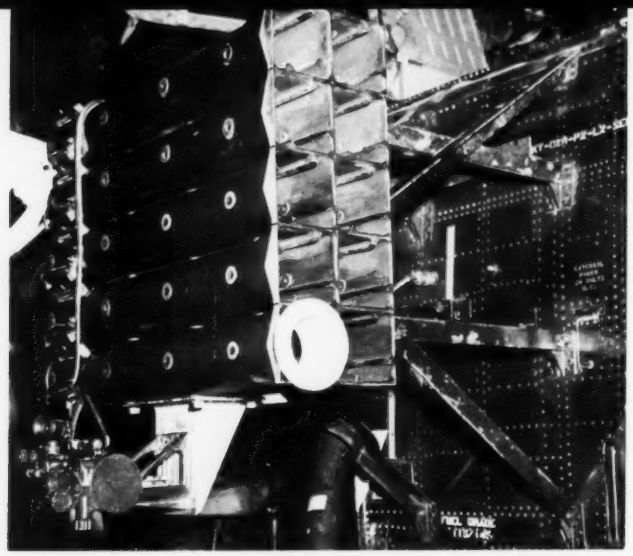


Photo 10

The CH-34 Choctaw (above) firing 4.5-inch rockets could deliver the same firepower as one volley from a battalion of 105 mm howitzers. The U. S. Marine Corps experimented with a CH-34 (below) that was armed with the Navy's Bullpup missile mounted on one side and a twin 20 mm gun pod on the other

helicopter was equipped with a Sonar listening device, depth charges and torpedos. The Navy has also conducted experimentation with General Electric on the development of 7.62 mm minigun turrets for the UH-1E.

The U. S. Air Force used the HH-3E helicopter built by Sikorsky as a rescue helicopter. This aircraft mounts the 7.62 mm minigun attached to the pylons on each side (photo 12). The Air Force also experimented with the General Electric GAU-2B/A, 7.62 mm minigun mounted in each door of the UH-1F. Tests on this system were started in April 1966 in conjunction with tests of a 5.56 mm minigun.

The use of helicopters by the French in the Algerian War in the mid-1950s played a major role in crystallizing the need for fire suppression weapons on hel-

Photo 11

icopters. They conducted numerous experiments with machine guns mounted in the doors of helicopters.

In 1956 the French began receiving CH-21 helicopters and developing heavier armament systems. The first installation tried was based on a prototype installation jointly developed by the Ft. Rucker's ACR Company and Vertol Aircraft Corporation. This system consisted of two .30 caliber machine guns and two launchers of 18 rockets each mounted on a CH-21. The French later converted the system to 37 mm rockets because they preferred its wider dispersed pattern.

The French preferred flexible weapons with nothing smaller than 20 mm. Their 37 mm rocket mounts were designed to accept canisters holding 18, 36 or 54 rockets for each launcher.

The French were also experimenting with their SS-11 (now M-22) missile mounted on helicopters.

Coming Next Month

Part IV:

Weapons Systems (Early Experiments)

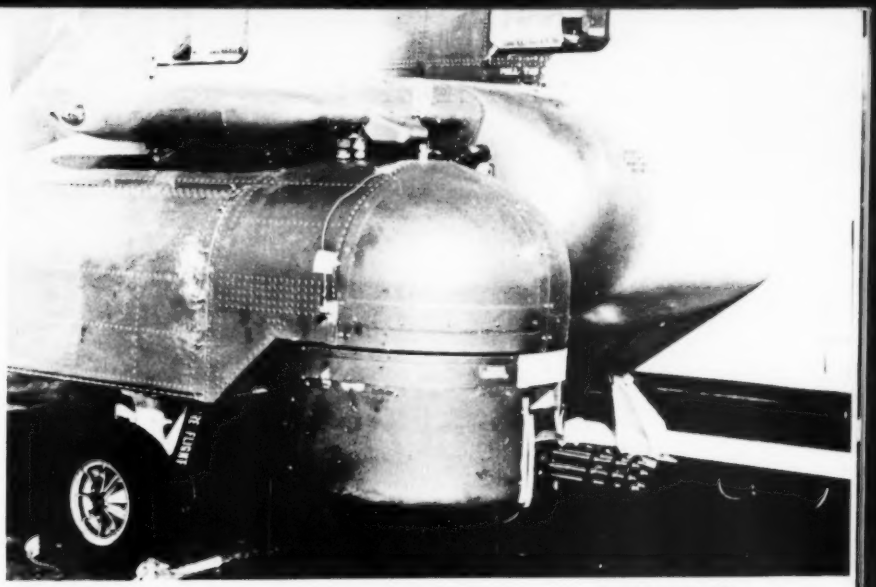


Photo 12

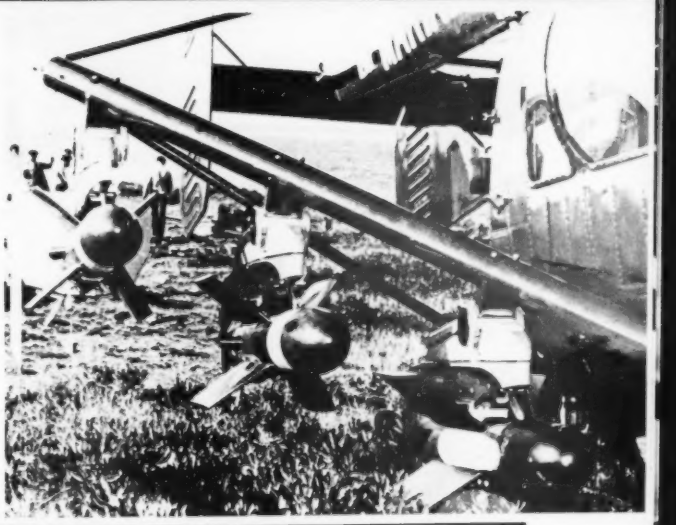


Photo 13

The U. S. Air Force mounted a 7.62 mm minigun (above) on the pylons of one of its Sikorsky HH-3E rescue helicopters. A Marine Corps HOK-1 (right) is armed with the French SS-11 (now M-22) missile

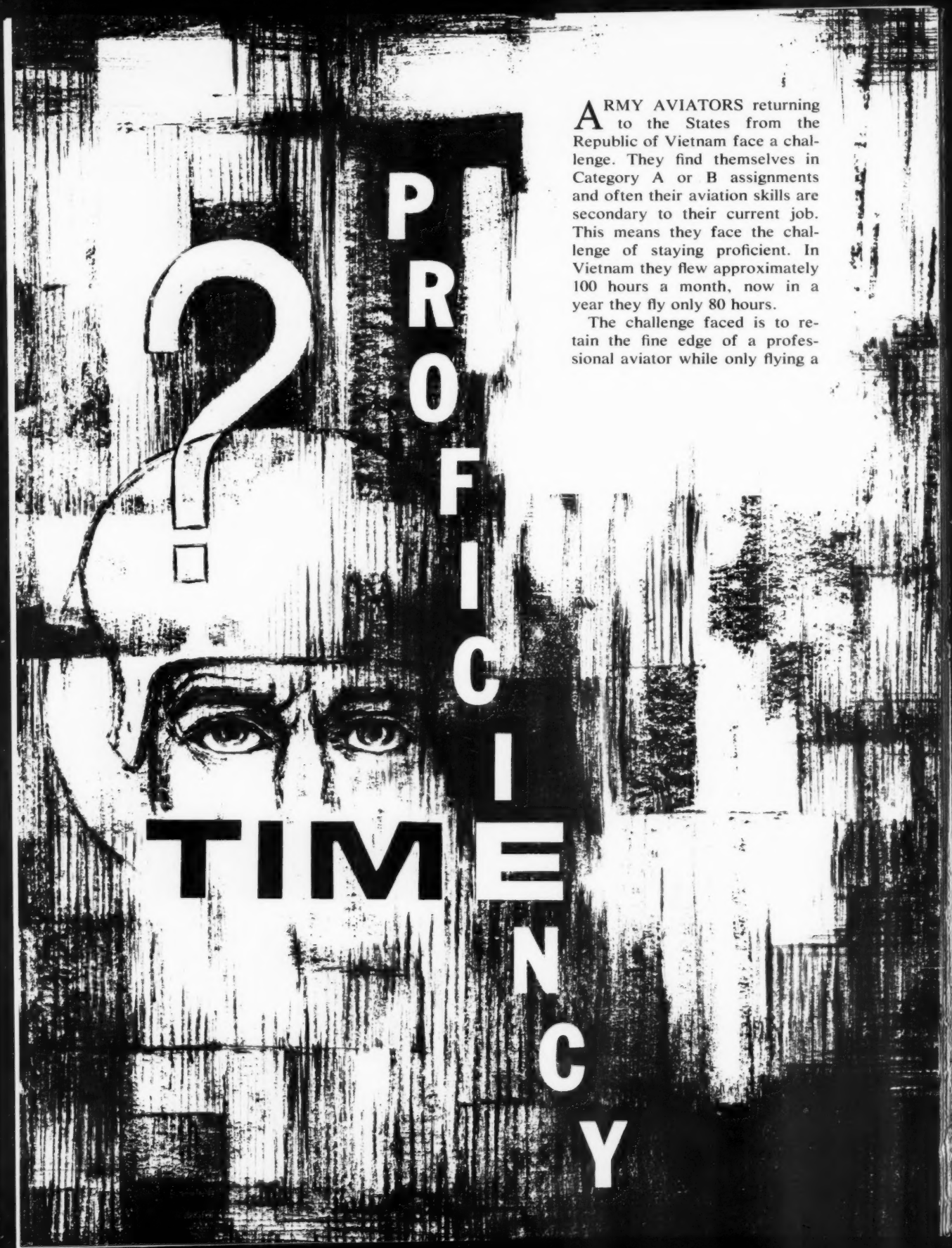
Aeromedical Evaluation—A Philosophy

Continued from page 15

made on purely medical grounds. The health of the aviator is the primary concern: if reasonable medical judgment contraindicates flying, both the patient and the physician must acknowledge that neither can morally participate in "occupational suicide."

These ideas are not new, nor are they original or conclusive. They represent an attempt to formulate in words a philosophical attitude which most of those who work in the specialized field of aviation medicine share. It is hoped that the expression of the philosophy may be helpful to individual physicians newly associated with this specialty, to associates in other medical specialties who may become involved in the evaluation of aviation personnel, and to the patients whose lives can be so immensely affected.

The basic issues involved in the aeromedical disposition of flying personnel have been defined. These issues are essentially those of resolving the conflict between the best interests of the individual aviator and the best interests of public safety. The issues are simple—the decision-making processes are complex. Those in the specialty of aviation medicine are human. They make mistakes too. It is hoped that the future will see the development of better epidemiological, statistical and clinical methods in predictive medicine so that such decisions can be made on a more definitive and truly sound basis.



ARMY AVIATORS returning to the States from the Republic of Vietnam face a challenge. They find themselves in Category A or B assignments and often their aviation skills are secondary to their current job. This means they face the challenge of staying proficient. In Vietnam they flew approximately 100 hours a month, now in a year they fly only 80 hours.

The challenge faced is to retain the fine edge of a professional aviator while only flying a

Challenge Of Proficiency

Captain William H. Campbell III

maximum of 80 hours a year. Aviators are required to fly 20 hours intrument, 15 hours of night and 20 hours of cross-country. It isn't difficult to meet these minimums—the problem is to stay a proficient professional.

Let's see what can be done to meet this challenge in the short 80 hours allotted. First, make each hour of flight time worth more by periodically spending some time studying. How about the AR 95 series? Just what is an aviator required to do and what can he do? Sure, rules and regulations, but let's face it, one doesn't play any game without rules. Neither should he fly without them.

Spend some time with the FLIP, sections I and II, reviewing procedures, abbreviations and available inflight services. Reviewing IFR and VFR Supplements and low altitude instrument approach procedures is also a good idea. Just refreshing your memory as to what information is located where will be of invaluable help. Remember some of the more important specific information and how to use each publication.

Having reviewed the general aviation information, dig out the dash 10s for all the aircraft in which you are qualified. Of course, the emergency procedures section should receive a lot of attention. Once a year is not enough, review emergency procedures until they are known by heart. Be able to visualize each switch and procedure and know exactly what to do if an emergency is encountered.

A good preflight may prevent inflight emergencies. Why not spend some time reviewing the amplified preflight, starting and runup procedures in the dash 10? Visualize each action as it is actually performed to plant them in your mind. Before putting down that dash 10 study it to get a good understanding of each of the aircraft systems, such as engine, electrical, hydraulic, etc.

Do you rely on what the aircraft has done in the past, or do you know its actual capabilities? Look what happened to Icarus when he overheated his feathers by flying too close to the sun; he didn't know the melting point of his wax. Don't you have a similar problem? Located in the back of the dash 10s are charts depicting the aircraft's capabilities; know the emergency procedures, aircraft systems and aircraft capabilities for each aircraft you fly.

Then consider the actual flight time. Each flight should be well planned to get the most from the aircraft scheduled. If qualified in more than one aircraft, especially both fixed and rotary wing, try and schedule a different type aircraft for each flight.

Next decide on the destination and the route, and here's where prior planning can really pay off. Don't get into a rut! Plan flights to as many different destinations as possible and vary the means of navigation. Use an IFR chart one time and a sectional or tactical chart another.

Plan to use the different radios in your aircraft. Don't rely solely on your UHF radio for communication if you also have an FM and a VHF. Your IFR and VFR Supplements, approach plates and enroute low altitude charts will help you to determine frequencies.

What about NAVAIDS? Use VOR and ILS approaches in addition to the common ADF approach. Don't forget the transponder; if your aircraft is so equipped, use it in conjunction with your flight following.

Even filing the flight plan can increase proficiency. Why not file a Form 175 just for practice? File it one way, and when you reach your destination try filing a civilian flight plan Form 7233 for the return flight. While getting the weather briefing, practice reading teletyped sequence reports. It's a great way to stay familiar with weather symbols.

Is there something else that may be done before takeoff? You bet there is! Put all that time spent with the dash 10s to use. Give the aircraft a good preflight remembering the amplified checklist and the aircraft systems. Ensure yourself of a safe aircraft. Use that checklist!

Finally airborne? Here are a few thoughts on the actual flight. Use a normal approach for one landing and a steep or shallow approach for the next. On some flights stay in closed traffic for an hour or so to practice different approaches. One last suggestion, fly with an IP once in a while for a really grueling practice at emergency procedures. A few rough periods with an IP may save your life.

Our challenge is to remain proficient while turning our efforts to another job. Man was meant to fly, but carefully!

YOU BE THE Judge

Situations come up every day in which aviators must make decisions; place yourself in this aviator's position and "You Be The Judge"

CW2 Peter VanAllen Agur Jr.

(The following account is true, the names are fictitious)

AN 0100 VISIT by a Viet Cong recoilless rifle and mortar team had rendered one pilot and two UH-1 Hueys in our unit out of action for the following day's missions. Although an aviator, I could not fill the void because I had only been with the company 5 days and couldn't get my incountry checkride until the company senior instructor pilot got back from R&R. However, several of the platoon members and I convinced our section leader that it would be in the best interest if I could fly relief on one of the ash and trash missions. He hesitantly agreed but said that the flight would also be a checkride.

The next morning after 3 hours sleep and feeling awkward in my new Nomex flight suit, armored chest protector, .45 caliber pistol and "leg" survival kit, I met John, my pilot in command. He informed me that all this, plus a survival radio (which we did not have due to a temporary shortage), was required on any mission in our area of operations.

At operations we picked up the mission sheet and the aircraft assignment, a second platoon ship that had been taken off of its day down and reassigned to us. The regular crew chief had returned stateside the previous week and somewhere along the line the records had been fouled up and did not reflect one day's flight, which would have downed it for periodic inspection (PE). Nor did they reflect that day's dash 13 writeup of "short shaft throwing grease." The previous day's crew chief had wiped down the head and drive train, but it was evident from the general condition of the aircraft that it had not received the care of a regular crew chief during the past week.

After completing our preflight and finding no other major discrepancies, except an inoperative transponder and a couple of moderately worn bearings (typical of a ship soon to go into PE), we took off with a normal crew of four plus the man who was to direct our mission.

For the next 5½ hours we flew a series of resupply shuffle flights with John giving a local area orientation by pointing out landmarks such as rivers, mountains, forests and settlements and their impossible-to-remember names. We finally shut down for lunch at a Military Assistance Command, Vietnam (MACV) compound, 50 miles southwest of our home base.

During lunch we figured out our schedule for the afternoon. If we flew directly from one compound to the next, rather than doubling back to follow the dirt roads, it would eliminate one refueling stop and we could finish the mission by our scheduled release time. To decrease our load we left the mission coordinator at the MACV compound, intending to pick him up on the return leg.

After a perfunctory check of fluid levels we loaded the mail, ice cream and soft drinks. Before departing we topped off the fuel and ran a hover check, which showed 96 percent N1 at 31 pounds of torque with no loss of rpm.

Our first sortie was to a pinnacle about 15 miles west, near the Cambodian border, where we dropped off the mail and picked up two Green Berets medics.

The hover check was the same and the takeoff uneventful. As we started the climb from ground level (3,000 feet MSL) to 4,000 feet, John turned the air-

craft to a course over the triple-canopy, jungle-covered hills. This would cut 10 minutes from this leg of the flight.

We had been in a slow but steady climb for a couple of minutes, and I pulled out the mission sheet to mark down this sortie's load. There was a sudden "bang" behind us, the nose swung left and the aircraft began to settle. I glanced at the instruments as John entered autorotation; the engine had exceeded 7,000 rpm before the gas producer spun down to zero. We were only about 700 feet above the trees and the only open area in sight was beyond reach.

I flipped the transponder to "EMER," turned off the fuel and fumbled with the UHF radio. As I brought my head up to look for a landmark, I saw nothing but jungle coming up fast. I told John that he was "up" to transmit as he began deceleration, but there was no time.

The aircraft settled vertically into the treetops as John increased pitch to reduce rotor rpm. There was a series of severe lateral shudders as the rotor blades made contact with the trees. The foliage turned to a green blur as the aircraft fell and rolled 90 degrees to the right. We hit the ground on the right side.

Recovering from the initial shock, I could see a bush and settling dust in front of me. The only sound was that of spilling liquid and I smelled fuel vapors. Someone began moving around in back as John stepped down onto my seat and started pushing people out the open left cargo door. I tried to get up but found my harness was still locked. John had moved to the top of the aircraft and was trying to help our crew chief climb out. I gave a shove and climbed out.

The two medics were still stunned by the knocking about they had received, and I was leading them away from the aircraft when John realized the gunner was missing. He called the crew chief back and they began moving the thermal containers and soft drink cases which had pinned him. He had a painful shoulder injury but fortunately was able to walk without much difficulty.

John and the crew chief remained in the aircraft recovering weapons, first-aid kits and enough soft drink cans to quench any immediate thirst. I

helped apply dressings to the minor cuts and splinted a broken finger on one of the medics. John tried the radios but found the transmitters and battery had been destroyed on impact. We gathered ourselves and our gear together about 30 yards from the aircraft.

It was now about 1530. We had not reached sufficient altitude to establish flight following, so it would be at least an hour before we would be missed and another hour before aircraft could arrive to search for us. Shortly after that the search would have to be terminated because of darkness.

In looking over the maps of the area and talking to one of the Green Berets, we determined that we were about 9 miles from our point of departure. The Special Forces sergeant told us he was familiar with the area, and that we were very close to a major Viet Cong supply route. We decided to walk back to our departure point.

Gathering up our weapons, as much ammunition as we could carry and several soda cans, we started out. After a short time of pushing through the jungle, I pulled on my Nomex gloves to protect my hands from the thorns. I had spent some time in the tropical rain forests of Hawaii, but that was open country compared to the intense growth here.

We had been following compass headings into a small valley, in which trees were scattered enough to show us a comparatively large portion of sky, but the undergrowth was still very thick. As we stood and rested for a moment, we became aware of the sound of a large plane in the distance. A C-130 appeared but it was very high and obviously not looking for us.

We worked out our dejection by forging on, and soon came to a stream about 6 feet wide. After helping each other across, we found that everyone except myself had picked up leeches. I assume that this was because I was the only one in the group wearing Nomex. After burning off the leeches with cigaretts, we continued to move up the other side of the valley.

It was now 1630 and the light was already beginning to fade in the shade of the hills. We pushed on for an hour but it was getting increasingly harder to see. We elected to stop for the night when we reached the top of the ridge.

I had just crossed a large fallen tree when we heard the engine of a small fixed wing. From the changing sound of his engine, it was obvious he was making a search pattern, and working our way.

John and I pushed our way through the bushes to an opening in the trees. We waited with penguns ready for the plane to come closer and turn our way. But the flares cleared the trees by only a few feet, and the pilot or observer would have to have been looking directly at them to see the little red stars.

Our spirits began to fall as the plane turned away, continuing its pattern. John put down his flare gun and quickly loaded his M-16 with tracers. Again we waited.

When the plane turned back our way, it was abreast of us and its next swing would carry it beyond us. This had to work if we were going to be picked up that night.

John fired three series of three tracers spelling out S O S up through the hole in the trees. The plane continued toward us. I fired by pengun once more, and the pilot began to circle his Bird Dog over our location. He evidently couldn't pinpoint us because his orbit began to drift, so we turned on our strobe lights. His orbit stabilized and the O-1 was soon joined by a slick from our company that began searching for a suitable landing zone. The biggest opening nearby was the one we had fired through, so we set up a defensive perimeter as we awaited the arrival of a hoist ship.

The Bird Dog stayed on station, but the Huey must have been running low on fuel because it broke orbit after about 15 minutes. Night fell as we strained our ears for the sound of rescuers. Finally we heard the medevac hoist ship and its protective team of gunships.

The gunships set up a covering pattern as the hoist ship hovered slowly overhead looking for a good hole with his searchlight. He stopped and hovered to the rear a few yards and slowly lowered the hoist. We scrambled the 10 yards downhill through the clinging briars to the waiting jungle penetrator. John and I opened two of the seats and got the injured gunner and the crew chief ready to be lifted. We signaled and watched as they worked their way up.

Soon the hoist came down again and the two Special Forces medics made their upward journey. The penetrator came down for a third time and John and I made the trip to safety. When I told the pilot that we were all on board, he eased the ship into translational lift and began climbing. By 2100 hours we were at home base.

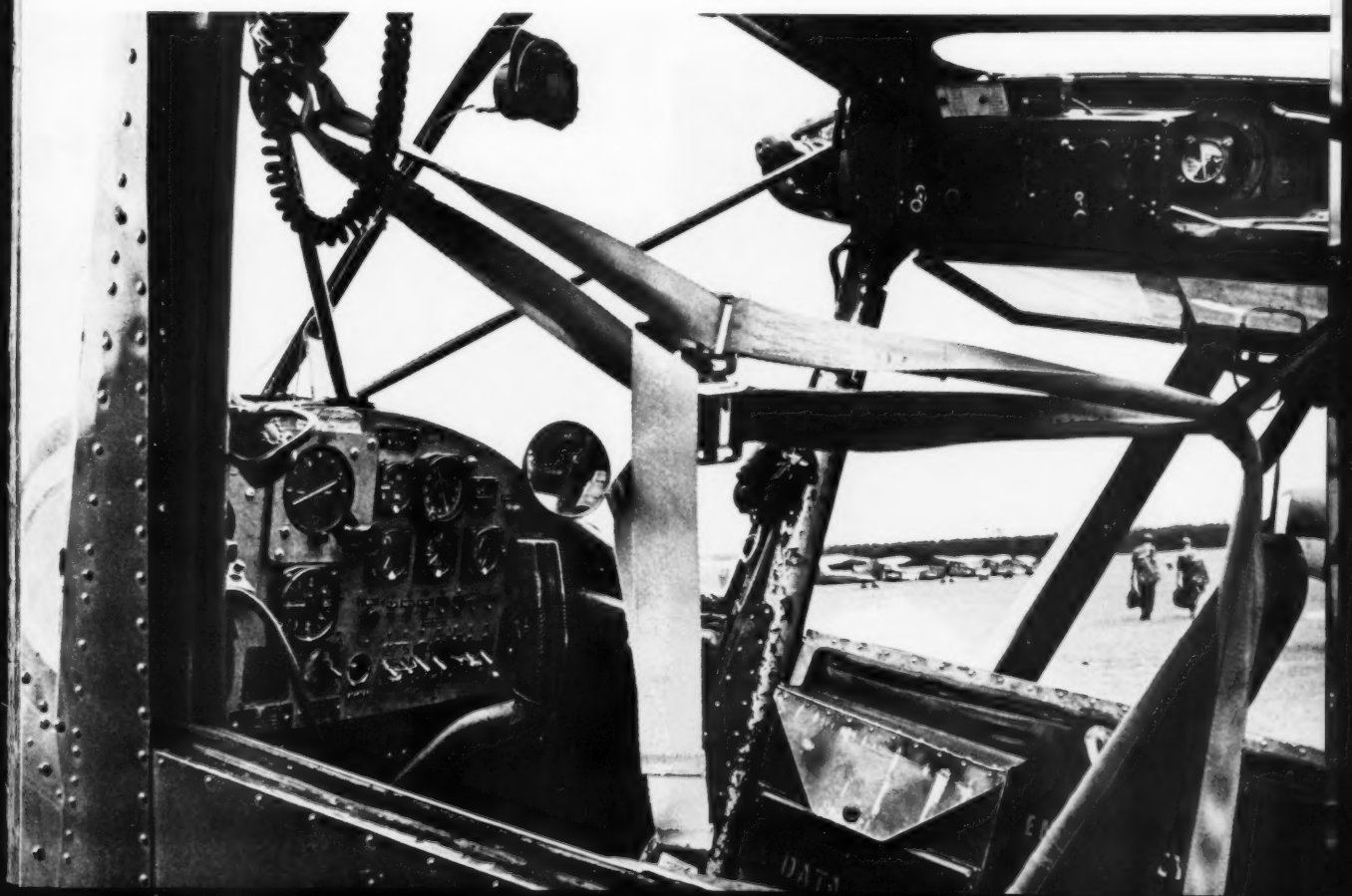
I will never underestimate the power of prayer, but should that power have been necessary? Of course not. How could all this have been prevented? You be the judge.

FINAL FIXED WING CLASS

Photographs and Story by Captain Tom Greene

The immortal Army O-1 Bird Dog (L-19) joined the L-4 Grasshopper of World War II fame as it passed into the annals of history at the U. S. Army Aviation School, Ft. Rucker, Ala., with the graduation of the last initial entry fixed wing flight class.

Only a few of the old warriors will remain on duty fulfilling Army commitments in Southeast Asia as well as meeting requirements for National Guard and Army Reserve units



Final Fixed Wing

A Milestone Fo

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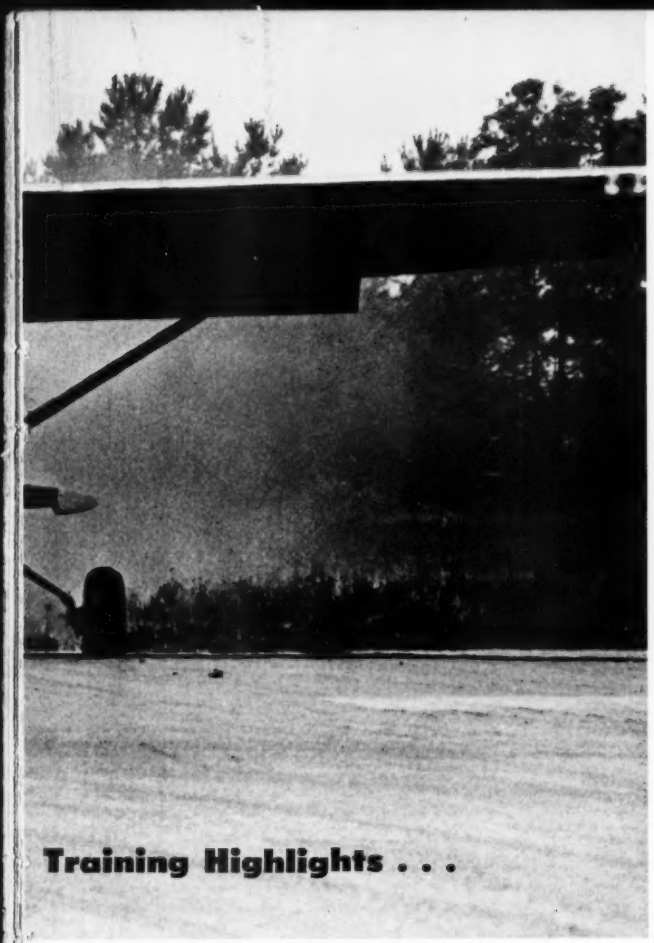


Training Highlights . . .

r Army Aviation

U.S. ARMY
AVIATION SCHOOL

US

Swearing in ceremonies (top left). CPT Roland C. Gates receives distinguished graduate certificate from LTC Joe Rogers (extreme lower left). New aviator CPT Jack Crabtree receives next best thing to wings (lower left). The L-5 owned by the Army Aviation Museum (above) is flown by COL J. Y. Hammack in tribute to "End Of An Era" flyby. COL Hammack (below) is the senior Army aviator at the U. S. Army Aviation School, Ft. Rucker

Initial entry fixed wing aviator training came to a close for U. S. Army aviation with the graduation of 35 fixed wing aviators of classes 71-17 and 71-18 on 29 June 1971. This event marked the end of a 29 year era in Army aviation history.

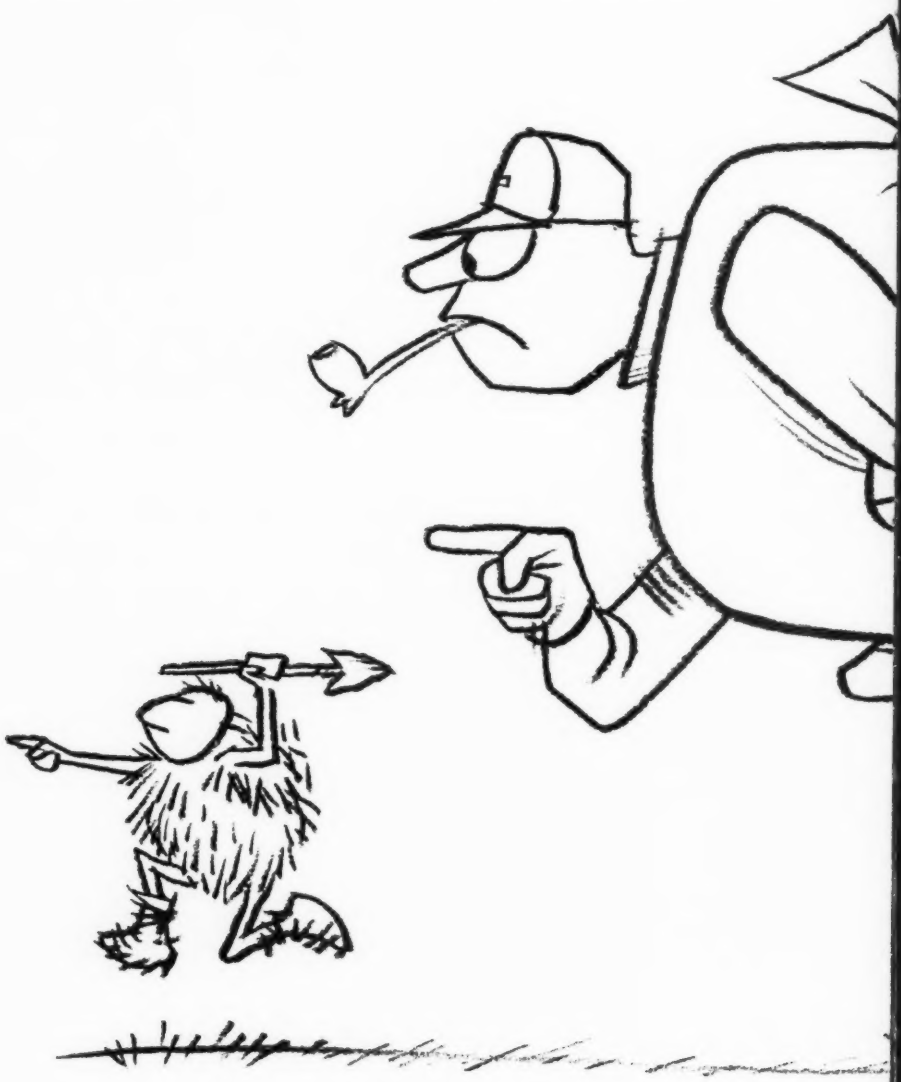
While worldwide requirements for Army rotary wing aviators increased over recent years, the requirement for fixed wing aviators decreased by 40 to 45 percent, thus a corresponding decrease in fixed wing aviator training. The initial entry fixed wing program supplied the Army with 446 fixed wing aviators in FY 71. With the elimination of this program the Army is able to reduce its training load to meet the reduction in Army fixed wing requirements.

Rotary wing aviators are now the main source for transition into fixed wing aircraft through qualification courses at Ft. Rucker, Ala. "Q" Course input for fixed wing training FY 72 is 446 students—a 70 student increase over FY 71. So for those who feared the elimination of fixed wing aircraft from the Army inventory as a by-product of the elimination of initial entry fixed wing training fear not, just pull pitch and drive on—fixed wing is here to stay.

EVERYBODY has heard of Oog the Caveman, the splendid chap who invented the wheel and who first hit on the worthwhile notion that a dinosaur steak might taste better broiled over an open fire with a dash of barbecue sauce rather than eaten raw. There should be a statue of Oog in every public park.

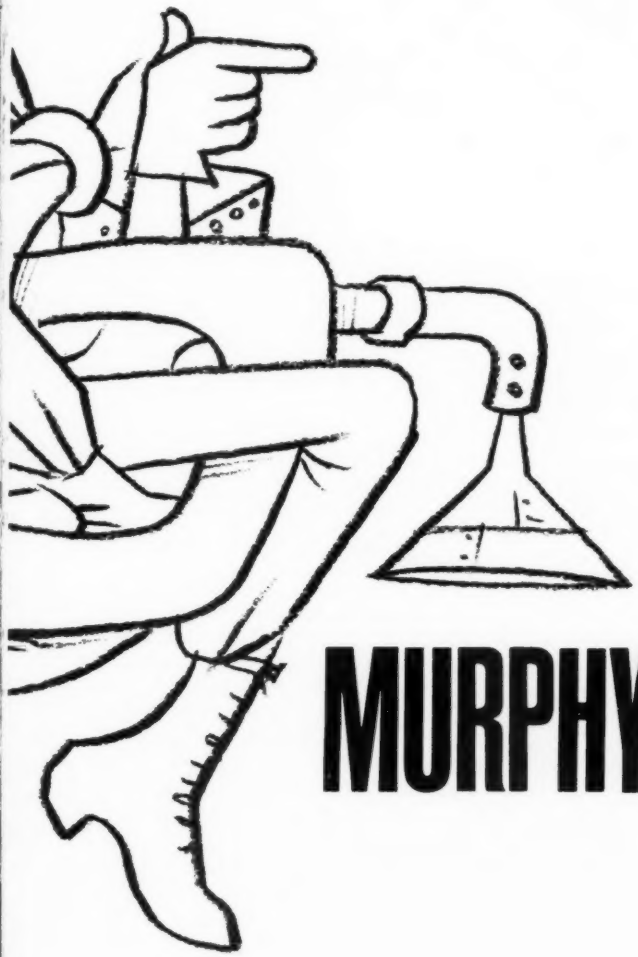
You won't find mention in history books of Oog's brother Erg, otherwise known as Young Chief Lamebrain. Erg installed the point on his spear backward one day just before he set out to bag a saber-toothed tiger. He never came back from the hunt, but everybody in the tribe had a pretty fair idea as to what had happened to him. They all agreed he had been living on borrowed time anyway.

Erg was the first known practitioner of Murphy's Law which, as we all know, is the stated principle that if there is any possible way to do something wrong, such as install an aircraft com-



ponent improperly, somebody eventually is going to do it. Historians differ as to who Murphy was and how the law came to be named after him. Whoever he was, he must have been the most snafued gent in history.

Chances are that Murphy has now moved on to Higher Things and is, at present, busily engaged in fouling up the heavenly choir. But his breed is by no means extinct. The law is operating just as efficiently as it was in Erg's day. What it is costing Army aviation is enough to make strong men—and taxpayers—sob into their beer.



MURPHY'S LAW SENSE

Major Chester Goolrick

The real truth is that Murphy's Law isn't really a law at all. It's a symptom of a disease, a disease for which there is no known permanent cure, to which nobody is immune (it is particularly catching by maintenance men), and which can be staved off only by frequent booster shots in the form of a never-ending campaign to remind all hands just how dangerous and costly it can be.

But if it is all around us and anybody can catch it, and it is hard to prevent, maybe we might as well throw in the towel and accept the fact that it is one of the common complaints you can't ever hope to root out completely. Most of us catch colds once or twice each year and have to suffer in silence. The best way to deal with Murphy's Law is to acknowledge that you can count on the ghost of Murphy to put in an appearance from time to time and there isn't much to be done about it.

Not so fast! Is this the sort of red-blooded spirit our pioneer forefathers had when they took on the task of building America? Where would we be if Dr. Salk had felt that way about polio? For a long time so-called scientists went around saying man would never get off the ground without the help of an extension ladder. Wilbur and Orville came along and proved otherwise. It is well worth pointing out they never would have got their flimsy contraption into the air at Kitty Hawk if they had allowed themselves to become victims of Murphy's Law. They were extra-careful, me-

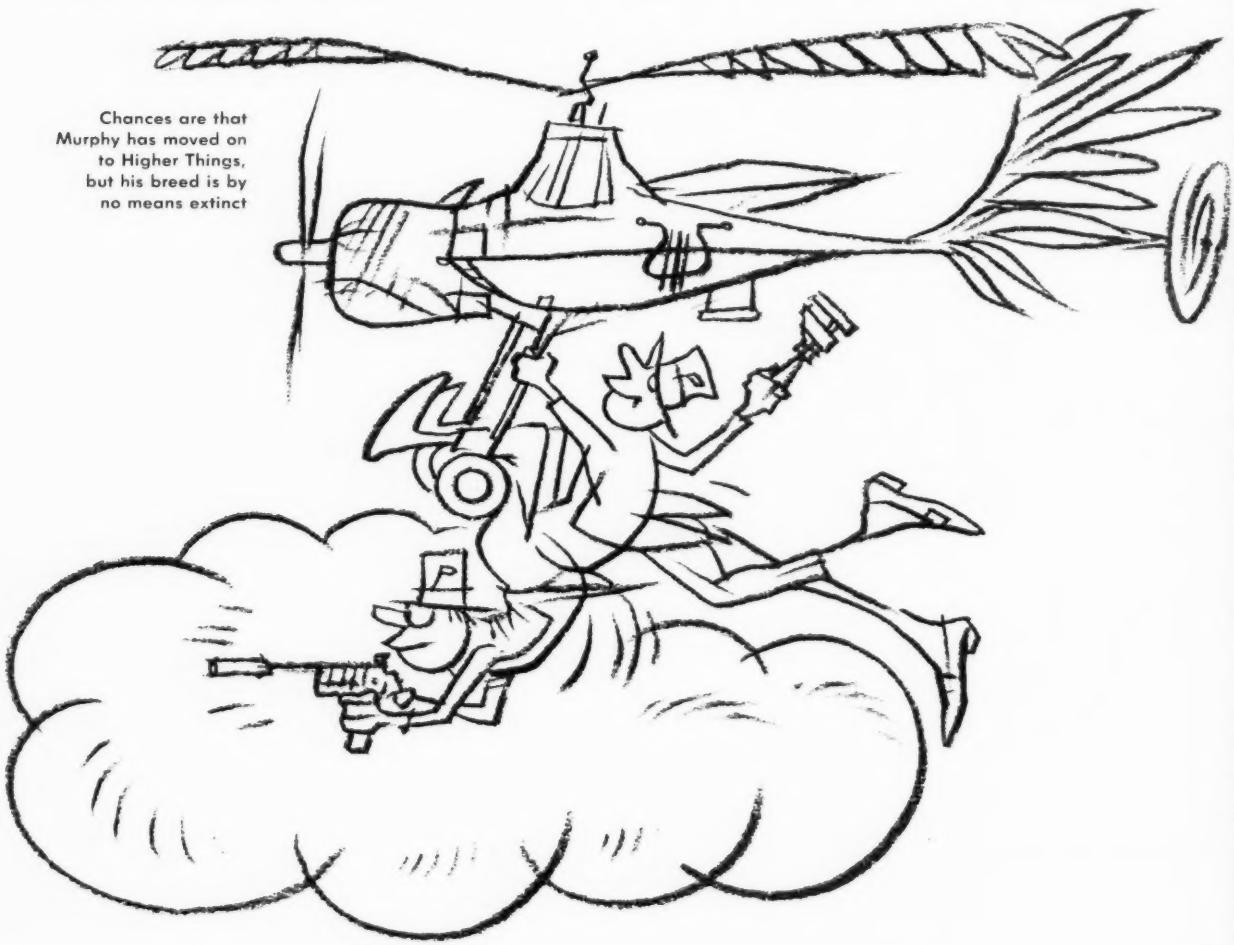
thodical lads, Wilbur and Orville were. They knew exactly what they were doing, how to do it and do it the right way.

Still, anyone whose heart isn't as stout as a chunk of solid oak might feel, on considering the situation, that it is, to say the least, discouraging. Repealing Murphy's Law might not be quite as difficult an assignment as sabotaging the Bill of Rights or the Ten Commandments. It is no cup of tea with cream and sugar, either. When Murphy drew up his law away back when, he provided that it should operate on a 24-hour basis the year round. It has been going full blast ever since.

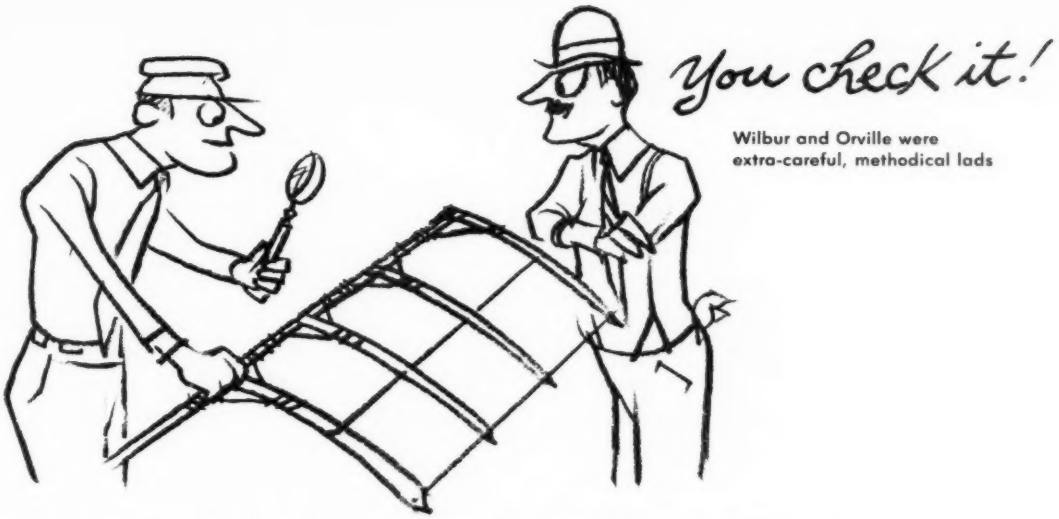
Applying the brakes to it after all this time won't be easy. In Army aviation, it needs to be done—in fact, *has* to be done. One thing is sure. Not even Hercules could do it by himself. What is required is a team effort from top to bottom of the sort worthy of those hard-working souls in ancient Egypt who built the Pyramids with their bare hands. If Murphy's Law is going to be permanently kayoed, the attack will have to move forward relentlessly on a front as wide as the Mississippi in flood tide, and just about as deep.

What's at the heart of the problem?

As a starter, there aren't any accurate statistics as to the incidence of Murphy's Law in Army aviation at present. More than we need, certainly, by a long shot. What we do know is that reports of Murphy-induced accidents keep coming in with the monotony of water dripping from a leaky faucet. The volume doesn't seem to be decreasing, either. In fact, as Army aircraft become increasingly complicated, it may be growing. We aren't taking any credit away from Wilbur and Orville when we say they didn't have the problems on



Chances are that Murphy has moved on to Higher Things, but his breed is by no means extinct



Wilbur and Orville were extra-careful, methodical lads

their hands a maintenance crew faces when it undertakes to cure an ailing Chinook.

If you happen to be one of those fortunate and rare souls who haven't as yet encountered Murphy's Law when it is operating at peak efficiency, a few examples might give you something to think about. You will probably even gladly enlist in the volunteer corps dedicated to the proposition that it is high time the ghost of old Murphy is finally laid to rest. Reading from right to left we come to the following prime displays in Murphy's special Chamber of Horrors:

STEP RIGHT UP, FOLKS

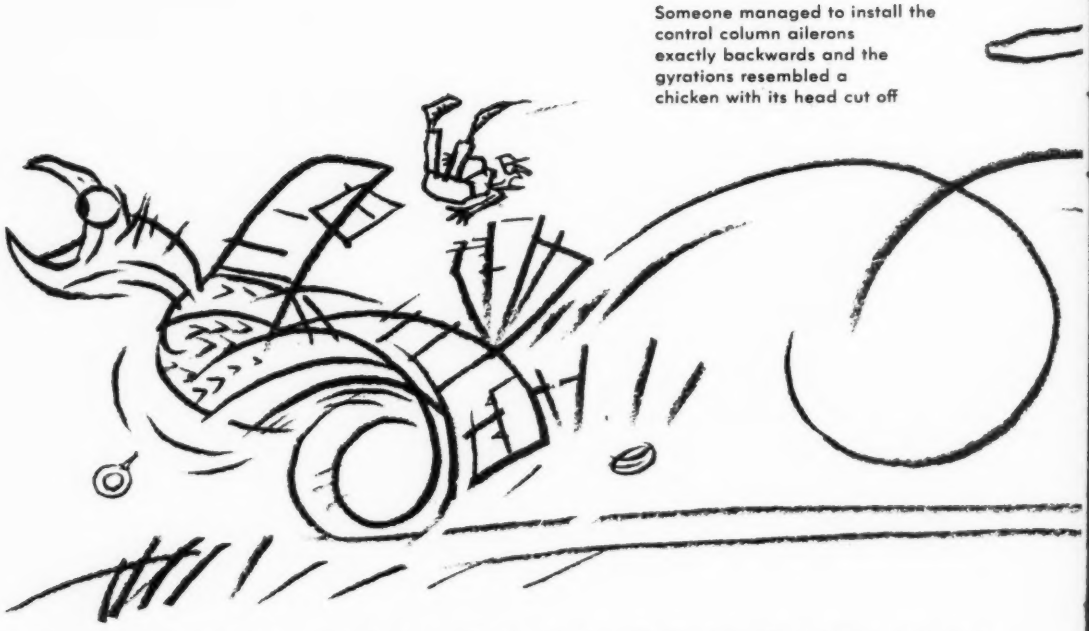
No admission is charged. As the first exhibit in the sideshow, we draw your attention to the hapless fixed wing pilot who felt his right wing drop just as he got airborne for a maintenance test flight. When he applied left aileron the wing dropped even more and struck the ground. The aircraft went into a series of gyrations which startled observers later likened to a chicken with its head cut off. What happened? Some direct descendant of old Erg managed to install the control column aileron chains exactly backwards, that's all.

Moving along, we come to a kind of double-entry Murphy. After the No. 2 engine of a Mohawk failed, it was discovered that not only had the oil strainer been improperly installed, but it was an outdated type. Fortunately, the Mohawk landed safely, but only after the external fuel tanks had been jettisoned. You don't pick up external fuel tanks in the dime store.

From the next display, we learn that if you install the tapered shim on a whip antenna of a UH-1D backwards, an occasional type of tail vibration sometimes causes the antenna to contact the tail rotor blades. The result can be a mess.

Two more exhibits bear witness to the fact that you can't always single out one culprit as the one who caused the wreck. Just about anybody can get in on the act. As often as not, they do. Investigation of a CH-34C crash during a test flight revealed the left lateral servo pressure line had been attached to the return low pressure fitting and the return line attached to the high pressure fitting—about as backwards as you can make it. Somebody whose mind had temporarily slipped its leash made the mistake, to be sure. But what

If Murphy's Law is to be kayoed, the attack will have to move forward relentlessly



Someone managed to install the control column ailerons exactly backwards and the gyrations resembled a chicken with its head cut off

about the maintenance supervisor, the technical inspector, the crew chief and the test pilot, all of whom had gone over the helicopter before the flight? They missed it to a man. The same happened after a mechanic servicing a U-8G nose gear shimmy damper disassembled the damper and then reassembled it with the shaft backwards and installed it on the aircraft. Investigation showed that none of the people who had checked the plane over had picked up the mistake. The result was a cracked damper attachment lug and other damage which took many man-hours to repair and cost many dollars. It could have been worse at that.

None of these accidents could exactly be termed typical. Murphy's Law cases are seldom typical and they pop up in a wide variety of shapes. But they do have one common characteristic: When you run into a case of Murphy's Law in prime shape, you can be certain of at least one thing—somebody, for some reason, isn't giving the job he has been trained to do the attention and skill it requires.

ROOT OF ALL EVIL

There is, when you stop to ponder, one thing more you can be sure of—when something goes off the tracks, when a well-designed piece of machinery suddenly stops working properly and begins to come apart at the seams, it didn't just happen. Somebody made it happen. A saboteur blowing up a dam or a munitions factory may not be the sort of fellow you'd care to have as a bosom buddy, but at least you can understand him. He is doing the job the Bad Guys hired him to do. An Army mechanic who falls under the spell of Murphy's Law, or the inspector who fails to spot the mistake—or anybody else, for that matter—is something else again.

All right, so let's make the sound assumption that nobody ever intentionally allows ol' Murphy to lock a half nelson on him. Yet it happens, all too often! What's the reason?

No reason. Reasons—about as many of them as there are grains of sand on the beach at Coney Island. No matter what the starting point, what they add up to is that a mistake is made by a trained man whose state of mind at the time is such that his wits go wandering off into left field somewhere at just the moment when he should be concentrating his full attention on what he is doing.

Want an all-too-familiar example? It is 6 a.m., you've just been jangled awake by an alarm clock

and, as you sit on the edge of the bed trying to pull yourself together, you are painfully aware that maybe you stayed a mite too late at the party the night before. So what happens? You try to jam your left-handed foot into your right-handed shoe. Murphy's Law at work, and you haven't even had breakfast yet.

It's fortunately true that this doesn't happen every day. Otherwise, you'd be going around with a permanent limp. It is also true that it happens to some people more often than others. We used to call these seemingly luckless victims accident-prone, but the experts on psychology have long since stowed that theory away in the dustbin. Instead, they'll tell you, the chap who always seems to have one leg in a cast or who keeps getting hit on the head by buckets of falling paint simply isn't taking the precautions most people do to avoid trouble. Walking around stepladders instead of under them isn't just superstition. It's also a good way to keep from being beaned by a gallon of outside enamel.

It is beyond doubt that some people have more get-up-and-go, more drive, more competitive spirit than others. The old boy in the poem who said that all he wanted from life was to sit in a house by the side of the road and be a friend to man may have been a kind soul. You'd be right in not wanting him tinkering around the engine of your helicopter with a torque wrench. He'd be as ripe a candidate for an attack of Murphy's Law as you'd be likely to run into in the course of a long day's walk.

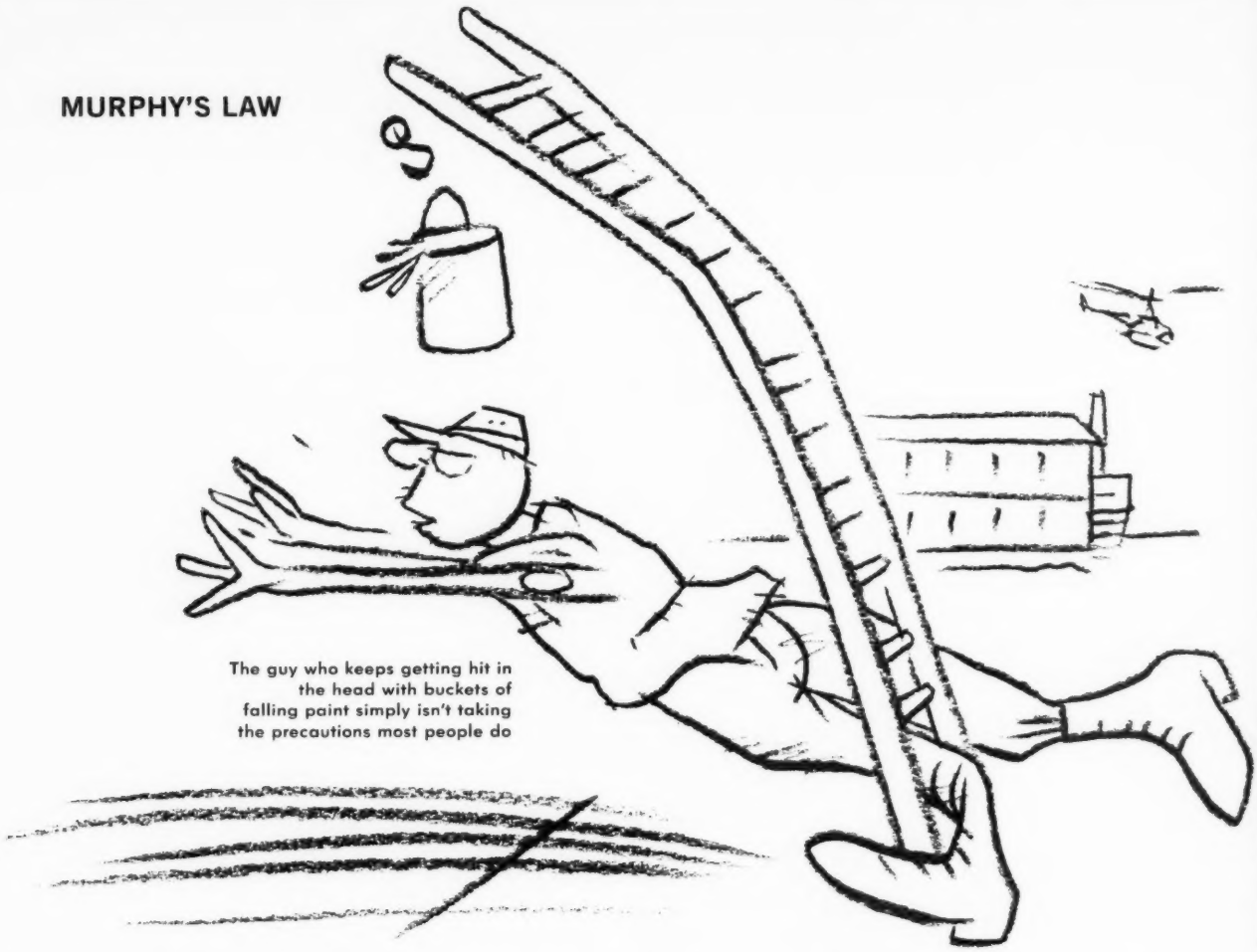
The type you are really looking for—you can be sure, anyway, that the Army is looking for—is the alert, competent professional who has long since realized how important his job is and that it has to be given his undivided attention and all the skill and energy he has. He's a friend of man, too, a good one at that, but he knows there are times when kind thoughts and a rocking chair philosophy come a long country mile short of filling the bill.

SLOPPY JOE

It's a simple fact that if you bring to your job all the snap and zip and zing of a worn-out inner tube you are as certain as next year's income tax to drift into a set of sloppy practices which come creeping up so gradually you don't appreciate their effects until it is too late. By that time you'll have a closer working relationship with Murphy's Law than a Supreme Court justice does with the U. S. Constitution.

There are plenty of outward and visible signs by which a Sloppy Joe can be recognized and set back on the straight and narrow before Murphy's Law grabs him. For instance, if his tool chest looks like the aftermath of an explosion in a hardware store, you can make book his general level of performance isn't up to par either. Suppose

When Murphy strikes, somebody, for some reason, isn't giving his job the attention and skill it requires



The guy who keeps getting hit in the head with buckets of falling paint simply isn't taking the precautions most people do

you ran across a cracked brass self-locking holding nut on the transmission plate assembly of a UH-1—as actually turned up on at least one occasion—instead of the steel nut that should have been there. You wouldn't have to be much of a Sherlock Holmes to figure out what had happened. Some Sloppy Joe somewhere was carrying around a mixed assortment of steel and brass nuts in his toolbox. Since they are hard to tell apart without the help of a magnet, he had used the wrong kind on the luck of the draw. To be fair about it, it might not have been the mechanic's fault. He could well have been the victim of supply bins which were not properly maintained and marked. It boils down to the same thing in the end—maintenance procedures as sloppy as the imitation custard pies actors used to throw at each other in those old silent screen comedies.

You are also free to draw your own conclusions when you spot a chafed teflon hose or one which has been bent out of the shape the manufacturer designed it to be. It didn't get that way all by itself. Somebody failed to grasp the importance of handling hoses so they can't get in this sorry state. That alone is one application of Murphy's Law. Give the offender enough time and leeway and he is capable of coming up with something even worse.

Or you encounter the man who has managed to convince himself that by-the-book procedures aren't really all that important. No matter what the book says, he has discovered something that not only saves time, but is a lot better. Just *maybe* he is right. A lot bigger *maybe* says he is sadly in error. If he can hypnotize himself into thinking he knows more than the book, there's a deadly chance that, sooner or later, he isn't going to be paying too much attention to whether he is installing a component sideways or upside down.

He needs guidance.

KNOW THYSELF

Substandard performances by competent and intelligent men who have all the professional

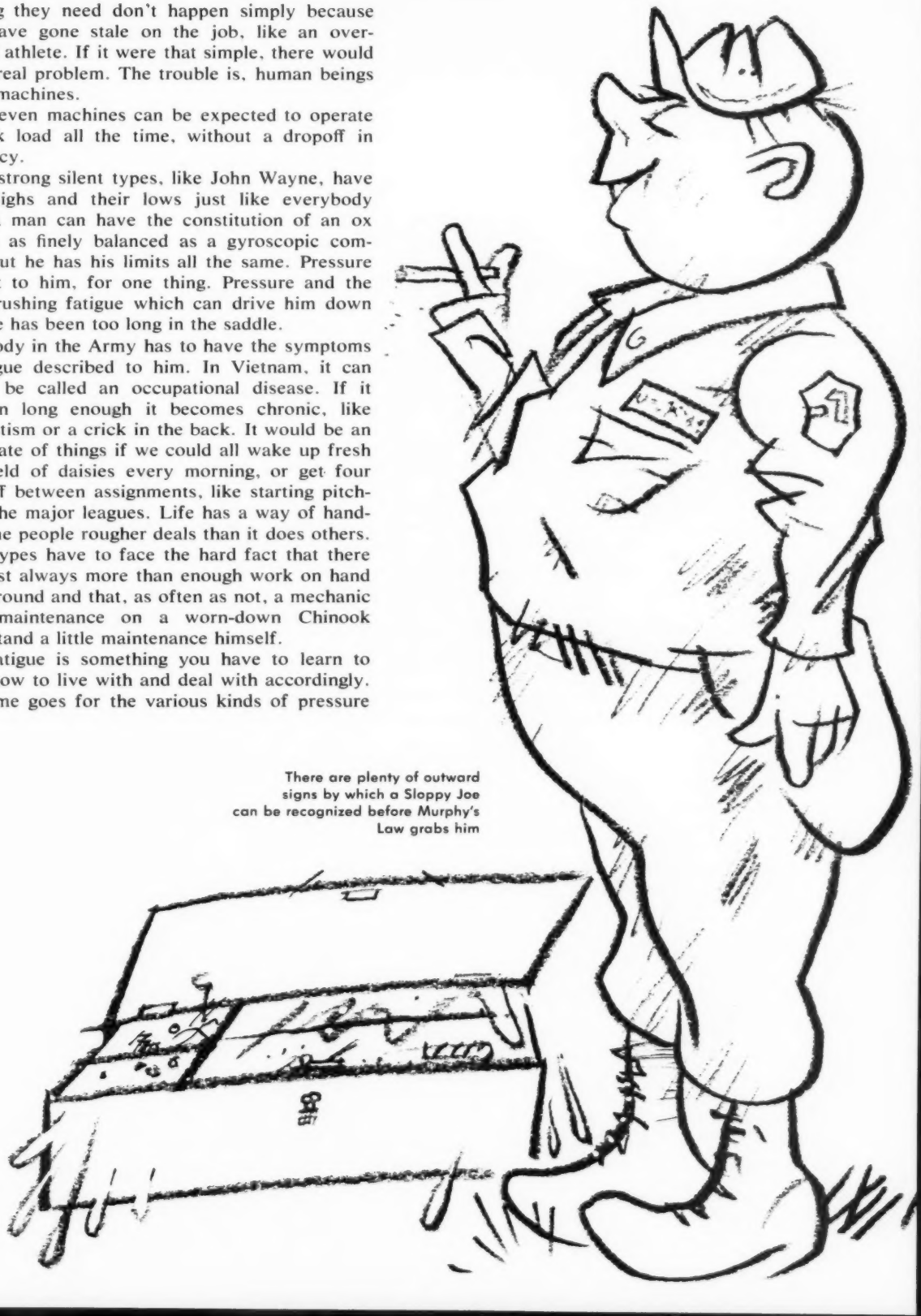
training they need don't happen simply because they have gone stale on the job, like an overtrained athlete. If it were that simple, there would be no real problem. The trouble is, human beings aren't machines.

Not even machines can be expected to operate at peak load all the time, without a dropoff in efficiency.

The strong silent types, like John Wayne, have their highs and their lows just like everybody else. A man can have the constitution of an ox and be as finely balanced as a gyroscopic compass, but he has his limits all the same. Pressure can get to him, for one thing. Pressure and the bone-crushing fatigue which can drive him down after he has been too long in the saddle.

Nobody in the Army has to have the symptoms of fatigue described to him. In Vietnam, it can almost be called an occupational disease. If it goes on long enough it becomes chronic, like rheumatism or a crick in the back. It would be an ideal state of things if we could all wake up fresh as a field of daisies every morning, or get four days off between assignments, like starting pitchers in the major leagues. Life has a way of handing some people rougher deals than it does others. Army types have to face the hard fact that there is almost always more than enough work on hand to go around and that, as often as not, a mechanic doing maintenance on a worn-down Chinook could stand a little maintenance himself.

So fatigue is something you have to learn to know how to live with and deal with accordingly. The same goes for the various kinds of pressure

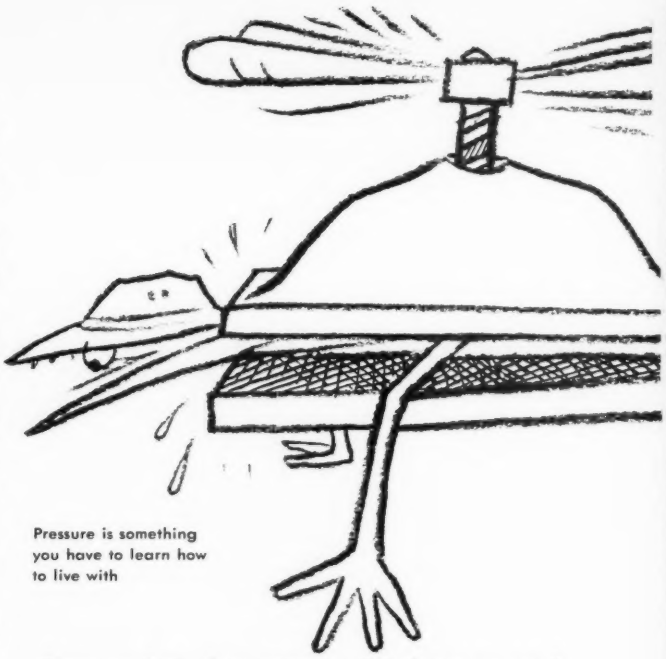


There are plenty of outward signs by which a Sloppy Joe can be recognized before Murphy's Law grabs him

which can pile up to the point where they can threaten at times to push anybody off the deep end, even though he is normally as stable as the Rock of Gibralter.

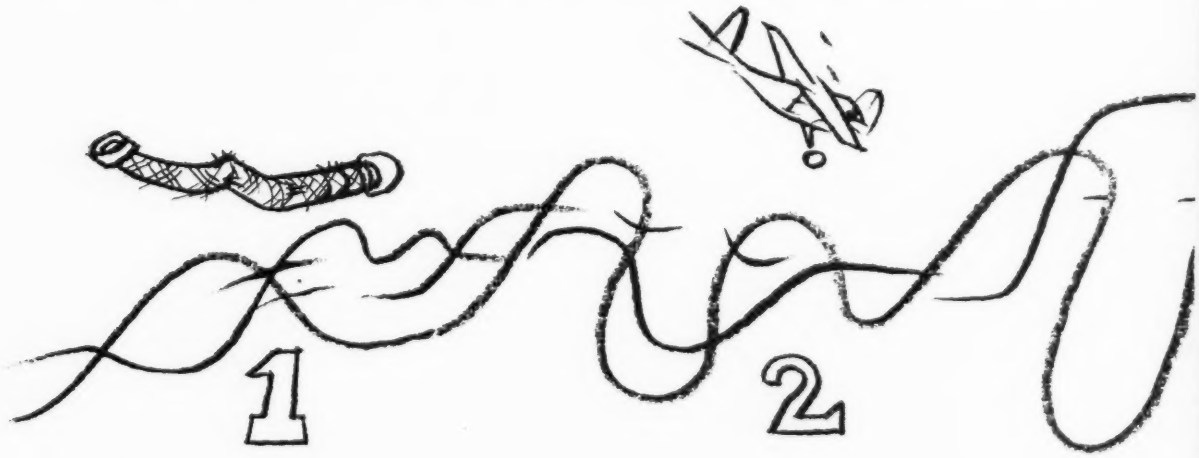
Into each life, as somebody observed back about the time Erg vanished from the scene, some rain must fall. When you bump into a cheerful soul who is ready to swear a solemn oath that he hasn't got a problem to bless himself with, you can be absolutely certain that he is either (a) whistling in the dark to try to hide from himself the fact that he has problems which are gnawing on him like a dog on a bone, or (b) his subconscious has taken over and has managed to put a temporary, and only a temporary, lid on troubles he long ago gave up trying to handle. Either way, he is a good choice, if you have to pick somebody, as a likely candidate to fall into an ambush laid by Murphy's Law.

When problems get so big they threaten to roll over us like a tidal wave, sensible people look around for help—from the doctor, the chaplain, a lawyer or the friendly neighborhood bank. Just the same, we are all pretty complex pieces of nervous machinery. It is the minor, everyday woes which usually make us operate under the mark if we don't watch ourselves. Perhaps there is worrying news from home. Or we struck out at the last mail call. Or we've had a run-in with somebody we had looked on as a trusted friend. Or—the list is endless. People have been known to go into a state of day-long gloom over a broken shoelace. It doesn't take a major calamity to shove anybody just enough off balance to cut in on his efficiency—cut in, that is, if he is not mature enough to take a deep breath and get a tight grip on himself.

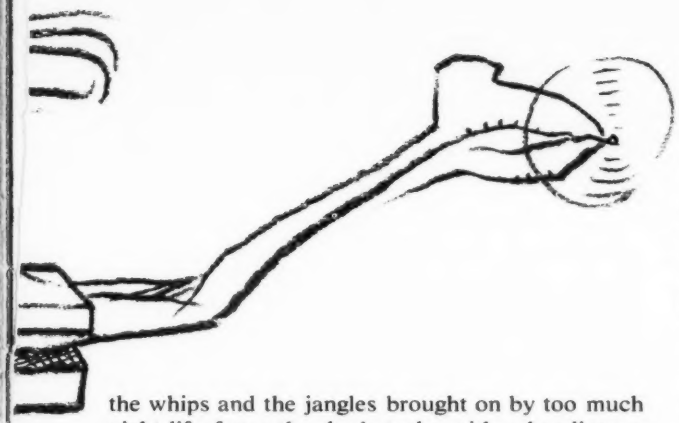


Pressure is something you have to learn how to live with

Physical ailments make up another burden everyone can be—and, at one time or another, will be—afflicted by. Major deals on Wall Street have fallen through, millions of dollars have been lost, just because some top-flight executive's stomach ulcer acted up at the wrong moment. A mechanic or supervisor with an abcessed wisdom tooth, a cold in the head or even a severe case of



If he can hypnotize himself into thinking he knows more than the book does there's a deadly chance he'll install a component sideways or upside down



the whips and the jangles brought on by too much night life faces the day's tasks with a handicap a furlong or so behind the happy spirit who is about to burst with blooming health and the kind of cheer you associate with Christmas Day. Again—Murphy's Law lies in wait unless the afflicted man faces the fact that he is not hitting on all cylinders and takes extra care.

Facing the facts is what it boils down to. Nobody can ever call himself mature until he has come to terms with himself and taken stock of his capabilities and limitations. There comes a time when most of us have to take it as gospel we will never play third base for the Baltimore Orioles, star in a movie with Sophia Loren or even be asked to give our views on the state of the world before a joint session of Congress. On a more everyday level we are forced to admit to ourselves that our temper thermostat may be set a notch or so lower than most people's, that we let little things bug us which others manage to brush off, and that when we develop a case of the blahs brought on by a bruised shinbone we are not going to do the job we should be doing unless we stop short and give ourselves a stiff talking to.

Probably nobody ever knows himself as well as his wife, or even his dog. But the man who has made a fair assessment of his abilities and his weaknesses and who is able to recognize that he is out of whack physically or emotionally, if only a little, can avoid the mistake can put him in Murphy's select fraternity.

TO THE RESCUE

It's another fact, though, that the Army is made up of a lot of people and you can hunt for a lifetime and not find any two exactly alike. What you would run across on any given day would be a fair number of men who, for a wide variety of reasons, were not at their physical and emotional best, or were pushed for time or in over their

It doesn't take much to cut in on his efficiency

heads on some particular job—and didn't fully realize the fix they were in.

Going one step further, this means that at any moment somebody somewhere is capable of following Murphy's Law to the absolute letter. Not a very happy thought, is it? Doesn't exactly make you sleep soundly at night.

It's not as bad as it sounds. The Army, as we've noted, especially when we are standing in line waiting for something, is made up of a lot of people. If everybody had always gone around doing his own thing the best way he knew how the country would have lost every war it ever fought, including the one against the Seminoles in Florida about 150 years ago. As matters stand, military men since the days of Alexander the Great have understood that the secret of success lies in tightly geared teamwork so that when a mistake is made, it can be spotted and caught somewhere up along the line before disaster hits.

In Army aviation, there are a number of automatic safeguards to keep Murphy's Law from

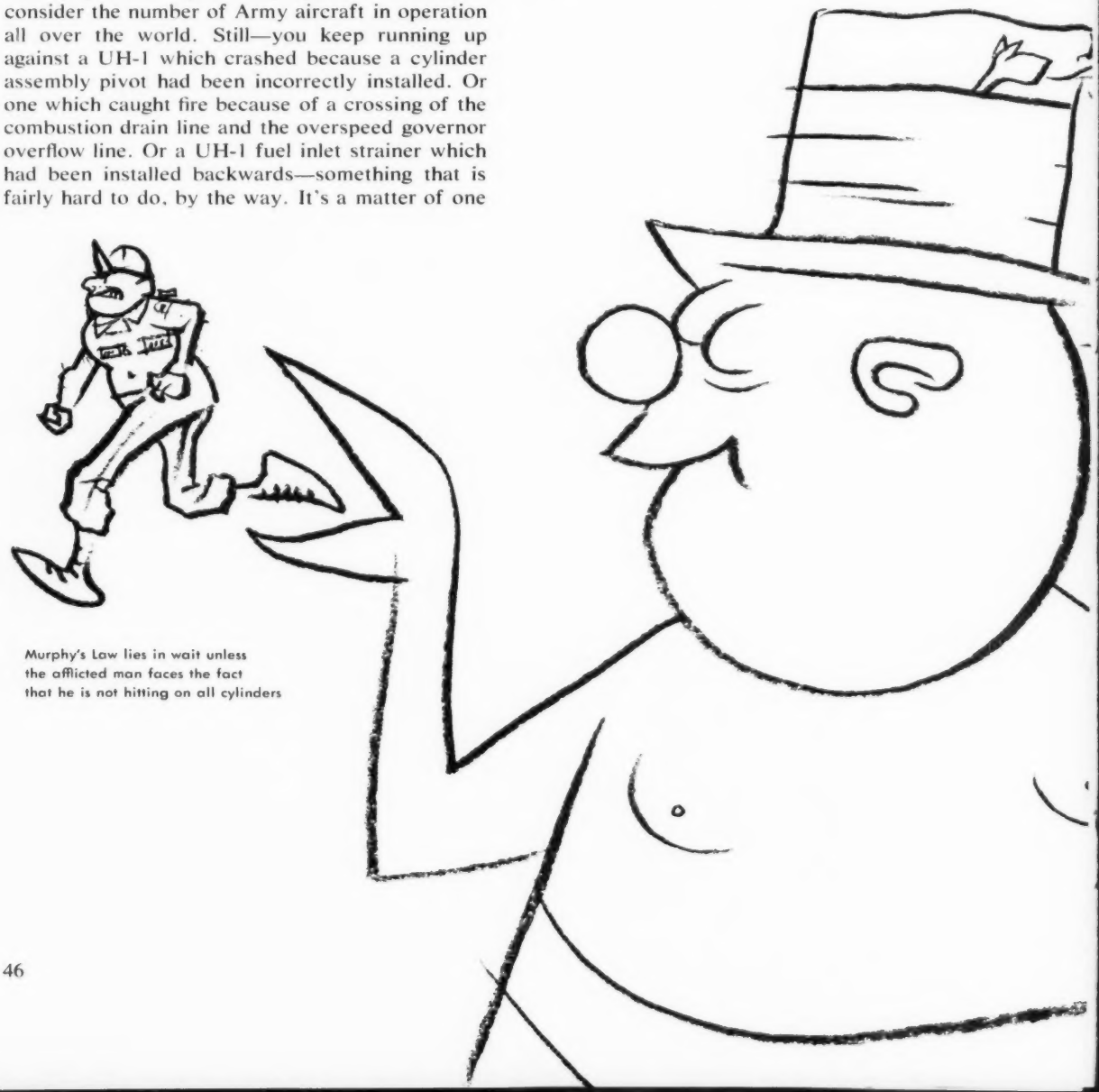
MURPHY'S LAW

running amok like a rogue elephant. Impressing all hands with what is involved and getting across the message that they should take extra care when they are under pressure or out of sorts is the logical starting point. After that, it comes to two built-in comprehensive insurance policies: (a) an *effective* supervision program, and (b) tip-top management policies to see that everything runs as smoothly as a custom-built and hand-manicured Grand Prix racer.

Supervision by itself should take care of the problem. Nine times out of 10, 99 out of 100, it *does* do the job. Cases in which Murphy's heavy hand are not detected in time to prevent trouble are really not of epidemic proportions when you consider the number of Army aircraft in operation all over the world. Still—you keep running up against a UH-1 which crashed because a cylinder assembly pivot had been incorrectly installed. Or one which caught fire because of a crossing of the combustion drain line and the overspeed governor overflow line. Or a UH-1 fuel inlet strainer which had been installed backwards—something that is fairly hard to do, by the way. It's a matter of one application of Murphy's Law being one too many.

It becomes as plain, then, as an extra eye in the middle of your forehead, that a supervisory program isn't the only answer, that it *isn't* something which, once started, can be counted to roll along on its own steam forever, like Ol' Man River.

Good, well-planned management practices provide the needed extra oomph to make both maintenance and supervisory practices effective. Henry Ford discovered, a long time before any of us was born, that a Model T, sturdy as it was, stubbornly refused to perform properly unless a top-flight management team kept a constant eye on the assembly line. In sports, good tight ends come—well, not exactly a dime a dozen, but good

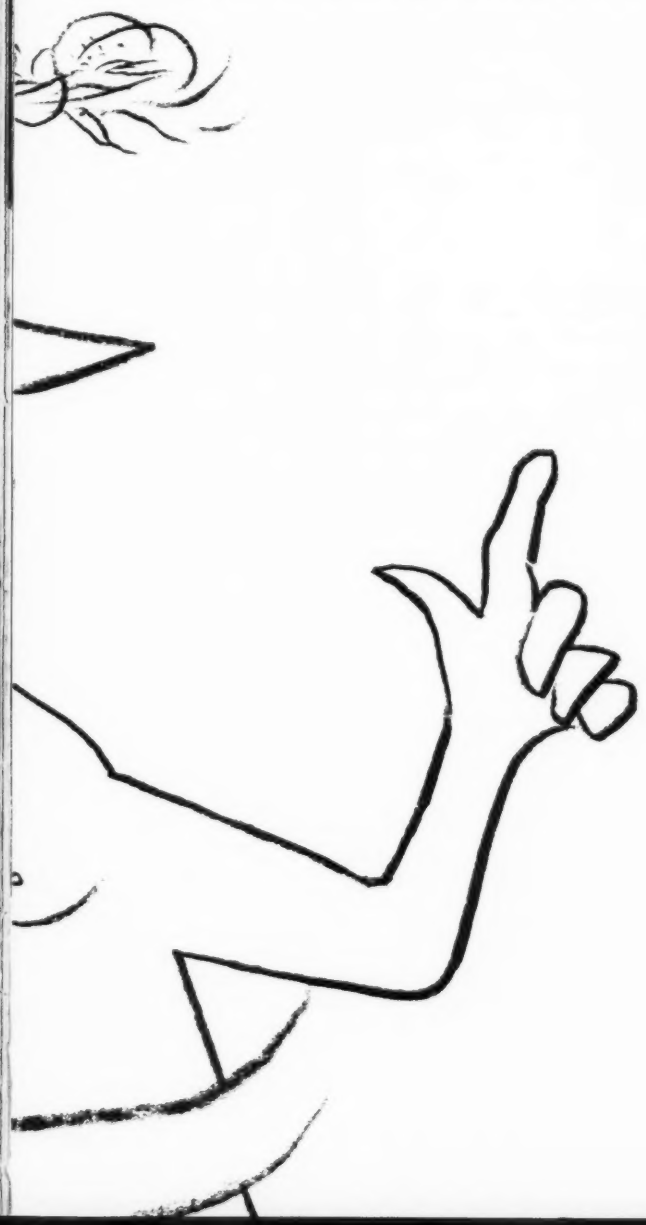


Murphy's Law lies in wait unless the afflicted man faces the fact that he is not hitting on all cylinders

managers are worth their weight in uncut emeralds.

An aviation management program which is soundly conceived and which really works, and works all the time, can cure a lot of trouble areas. Among other notable achievements, it can put Murphy where he properly belongs—in the history books along with other extinct species, such as the dodo and the passenger pigeon. Hardly anybody falls ill of yellow fever any more. Why should Murphy be allowed to hang around to plague us when a little constructive thought and action can get rid of him for once and all?

As an opening salvo against Murphy, a management program makes sure that everybody fully

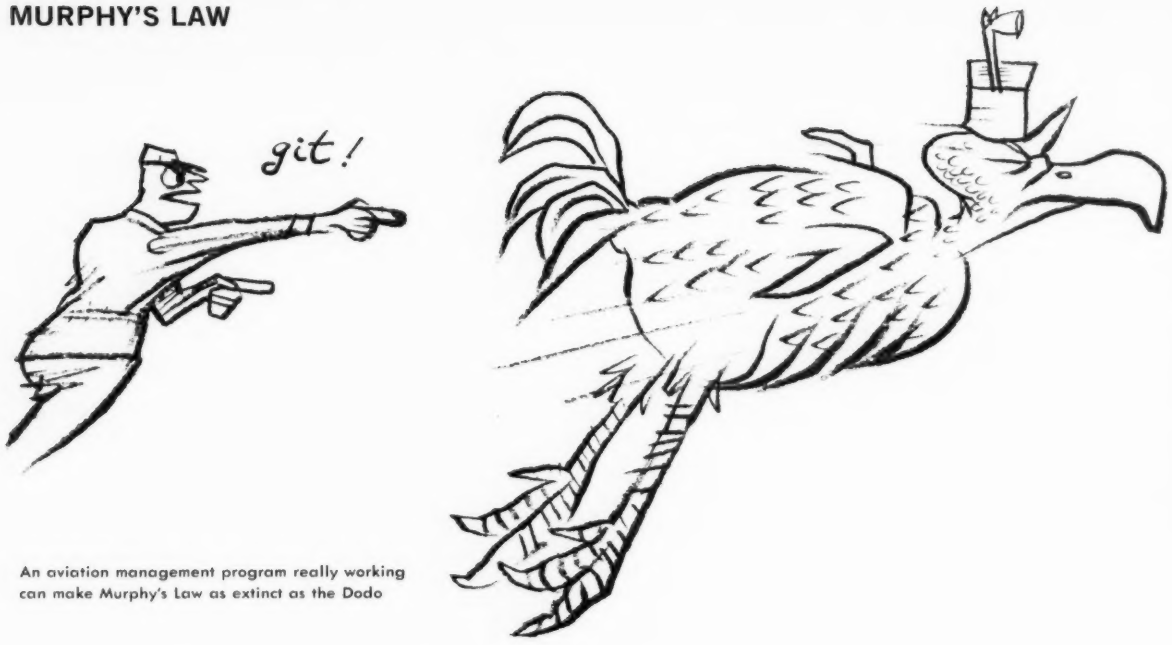


Probably nobody ever knows himself as well as his wife or even his dog

realizes that he is capable of making a mistake at any time, no matter how experienced he may be, and that the higher the pressure mounts the greater the risk becomes. Once this basic fact is driven home, the need for a thoroughgoing supervisory system becomes obvious to the point where a conscientious and responsible mechanic not only accepts it but goes out of his way to ask for it.

Every savvy maintenance man knows that the way to get a job done is to follow the book as painstakingly as he would a map pointing the way to Captain Kidd's buried treasure, test the system, give it a check and *then have it inspected.* Above all, he realizes the limits of his experience. He may have been on hand to help tune up the Spirit of St. Louis before it took off for Paris back in 1927, but there is always something new

MURPHY'S LAW



An aviation management program really working can make Murphy's Law as extinct as the Dodo

under the sun. The old hand isn't satisfied until he has a doublecheck by a troubleshooter who is on the prowl for mistakes.

That is really what the red X on the form is all about. It isn't there simply to indicate that a part has been removed. It means that a part has been removed which could be reinstalled improperly. It is a warning signal asking for a supervisor to have a looksee to check whether it is back in place right side up or upside down.

A MATTER OF PRIDE

Everybody likes to think he is doing his job in bang-up fashion and most people with normal, healthy, self-pride give it that little extra something which distinguishes an expert craftsman from the hohum journeyman workman who couldn't care less. Especially when other people's lives are involved, which is just about all the time in Army aviation.

What the man on the way to the top of his trade comes to find out, the sooner the better, is that nobody in this world with the possible exception of Robinson Crusoe or the original Lone Scout can ever hack it entirely alone. There may come a time when nobody will ever make a mistake, but it doesn't look as if it's just around the corner and it would be a good idea not to count on it. In fact, it is an even better idea to count on the occasional mistake as not only a possibility but a probability. The more alert, the more conscientious a man may be, the fewer mistakes, sure, but you would have to have a high opinion of yourself indeed to convince yourself you will never get nabbed by Murphy's Law.

So you are only playing fair with yourself, not to mention the air crew of the Huey you are working on, when you send out a call for a check if there is even a faint possibility something could go wrong. And if you are a supervisor, a technical inspector, a crew chief or a test pilot, the name of the game is to keep firmly in mind that you are looking, and looking hard, for trouble. Good detectives who want to end up as police commissioners spot clues on the scene of the crime an untrained eye would overlook. A nose-to-the-grindstone supervisor is like a bloodhound on the trail of the culprit who dunked the overalls in Mrs. Murphy's chowder. That's a case of Murphy's Law for you, by the way, and it is a sound assumption that Mrs. Murphy did something about the situation when she found out about it.

She would be the first to agree that Murphy's Law has got to go. She would also admit the overalls wouldn't have got in the chowder if she hadn't turned her back to the stove.

Turn your back on Murphy and he will nail you in the end. You, and what's just as likely, some other good men you wouldn't want to have on your conscience for the rest of your life.

CW3 Arel E. Childress
Aircraft Accident Analysis & Investigation Dept.
USABAAR

METHODS--MANNER--SPIRIT

A RECENT class at the Aviation Safety Officers Course, University of Southern California, was asked to write a paper on "The Solution to Professionalism in Army Aviation." These students ranged from young, relatively inexperienced pilots to aviators with thousands of hours and many years in aviation. Responses were many and varied. However, everyone agreed there was a problem in this nebulous area called *professionalism.*

What is professionalism? What makes a professional? Funk and Wagnalls gives this definition of professionalism: The methods, manner or spirit of a profession; also, its practitioners. A little rewording gives us this definition of professionalism in Army aviation: The methods, manner and spirit in which Army aviators and maintenance personnel perform their mission—methods—manner—spirit. Let's look at these terms as they apply to Army aviation.

Methods: In any profession there are many different ways to perform a task. However, there is usually one way that is best. This one best way has normally been tested many times and modified or changed when necessary. This method has proven to be the one that will give the best end product the safest way possible. From the first day we enter Army aviation we are taught these "best methods." They are outlined in various publications—ARs, TMs, dash 10s, checklists, SOPs, etc. Yet, with all this training and guidance, we continue to have accidents like these:

A CH-47A crashed during takeoff due to an overgross of 3,000 pounds.

A CH-54A was destroyed during a maintenance runup. This was caused by maintenance personnel leaving a special tool in an area where it became lodged in the controls.

A UH-1B crashed during a VFR administrative flight due to improper fuel management.

These are a very small sampling of the mishaps on record which were caused by NOT using the best method.

Manner: The manner in which we perform our daily missions is just as important as the methods we use. The correct method, if used in the wrong manner, will produce the same result as if the wrong method were used. It does no good to use a checklist to satisfy the regulation if each item is not physically checked.

Spirit: Many mishaps have occurred due to overconfidence and strong desires to complete missions. Mission accomplishment is essential, but this must be seasoned with good judgment. You don't attain mission accomplishment by destroying your most valuable resources—men and machines. Pride in yourself and a job well done is a very real and desirable goal, providing you don't get caught by a sense of false pride.

The following letter was written in the spring of 1918 by an American aviator flying in France:

"Dear Dad,

"You asked about the dangers of flying and the number of mishaps that occur over here that result in fatal injuries. Relatively few of our craft are destroyed by enemy action. I would say that complacency or a false sense of adequacy causes more crashes than any other factor. Aviators attempt unauthorized maneuvers, run out of fuel, become disoriented or lost, fly low level and crash into obstacles or attempt takeoffs or landings that are not within the capability of their aircraft.

"The craft that we fly are relatively safe and, in most cases, prior planning and professional competence normally result in a safe landing if a mechanical malfunction occurs. The loss of aircraft to the enemy is an accepted risk and is the nature of war, but at times it is difficult to understand why, with the inherent risks of combat always present, our aviators make such stupid—that is the only way to describe them—stupid mistakes. I imagine that as long as man experiences the exhilaration and freedom of flight, and the need to foolishly exhibit his manhood and mastery of his machine, accidents will continue. A competent aviator must realize both his own and his aircraft's capabilities and limitations, especially in a combat situation. A loss of an aircraft, whether by enemy action or by accident, is still a loss to our cause. To better answer your question—no, it is not dangerous to fly. Our machines are adequate. It is the human who is dangerous."

It's good to know that, as professional Army aviators, we don't make these same stupid mistakes today.

SPH-4 Helmets

As an aviation safety officer of an aviation battalion (CBT), I have a somewhat out-of-the-way problem. Our battalion is equipped with only rotary wing aircraft—OH-23s; OH-6As; UH-1Bs; UH-1Ds; CH-47A, B and C models; and CH-54As and Bs.

AVIATION ACCIDENT PREVENTION FORUM

an interchange of ideas between readers and USABAAR on subjects of aviation accident prevention

At this time a quantity of SPH-4 helmets is inbound to our central issue facility. The Army has provided no issue priority such as types of aircraft. The only issue priority has to do with geographical locations and our central issue facility operators will not accept the issue priority I have proposed.

I would like to see issue of the few SPH-4s to those people in the category with the greatest compensable hearing loss potential, instead of others. An example of "others" is myself in a primarily staff function. I hope to enlist the help of the flight surgeon and the hospital commander in getting the post commander to direct the issue priority we need.

What I require is a listing, in order of need, of those personnel who should have hearing protection from the aircraft they crew. This listing should clearly indicate a factual basis for a proposed issue priority, if in fact one does exist. Possibly, with your aid, we will be able to get this equipment to the people who need it most—CWO-ASO

Central to the ASO's problem is the fact that, although the Army is currently procuring the SPH-4 helmet for issue in areas other than Southeast Asia, the procurement rate is not sufficient to allow issue to all pilots and crew members at this time. Despite the fact that all crew members need the added normal protection provided by the SPH-4 helmet to reduce noise-induced hearing loss, supply problems dictate establishment of some priority for issue.

A Department-of-the-Army message to various depots and commands stated that, until a sustained supply position can be attained, the following issue priorities will apply:

". . . Personnel regularly assigned to fly rotary wing aircraft where additional sound protection is required (i.e., CH-47) will receive priority issue of SPH-4 helmets. Others may wear the Standard B helmets.

"Personnel not required to fly regularly, or who fly for proficiency only, may be issued Standard B helmets.

"Medical certificates of need to prevent further hearing loss will be honored.

"SPH-4 helmets will not be issued for any purpose to personnel not on flying status. . . ."

Prior to the receipt of this message, USABAAR personnel in coordination with representatives of the U.S. Army Aeromedical Research Laboratory had established the position that the top issue priority—other than a flight surgeon's prescription for hearing loss—should be to those pilots and crew members who fly aircraft producing the highest noise levels (CH-54 and CH-47). This position is in consonance with the DA policy. The complete list of issue priorities for the SPH-4 set forth in this position is:

First—Crew members with demonstrated hearing loss, i.e., by prescription from a flight surgeon.

Second—Flight engineers and crew chiefs, CH-47.

Third—Pilot, copilot and crew members, CH-47 and CH-54.

Fourth—Aviators whose primary duty is flying.

Fifth—All others on Category A assignment.

Sixth—All others on flight status.

This priority list for the SPH-4 helmet was, of necessity, based on noise protection required by the various types of aircraft. It is hoped that supplies of this helmet soon will be plentiful enough to be issued to each aircrew member, regardless of the type

aircraft flown. In addition to reducing the hearing loss caused by aircraft noise, the SPH-4 (if properly fastened) has been found to reduce the incidence of head injuries during a crash simply by staying on the crew member's head. A helmet is very effective in providing impact protection if it stays on the head, and staying on the head during a crash is a function of proper fit with the chin and nape straps secured correctly. The SPH-4 fits better than other helmets currently in the Army inventory and therefore stays on the head better. It has stayed on a crew member's head in a crash when other types of helmets worn by other crew members were dislodged. BUT THE CHIN AND NAPE STRAPS MUST BE FASTENED SNUGLY, AND THE HELMET MUST BE PROPERLY FITTED.

A study recently conducted by USABAAR shows that head and face injuries were not only the most numerous among impact injuries sustained in some 2,546 helicopter accidents studied, but also the most lethal. Head and face injuries accounted for almost one out of four fatalities (22.6 percent) which resulted from other than combustion effects and for one out of seven (16 percent) of all fatalities. These percentages say, "Fasten your helmet!"

CH-47 Restraint Systems

In a review of our battalion's CH-47 accidents, it was found that all deaths and injuries were attributed to crews not being restrained. The pilots in all cases were restrained and uninjured.

A survey of our Chinook unit found that, due to the need for crews to clear aircraft properly, monitor slingloads and perform various in-flight duties, they were not able to have adequate restraint. Specifically, on takeoffs, landings and loading, crew chiefs must lie on the floor to monitor slingloads. Gunners do not have seats provided and must stand to be able to see over the door.

We are requesting any information or ideas for the safety of our Chinook crews. We are concerned for the lives of these crew members and must find an answer before other needless losses of life occur.

This problem cannot be a new one, and surely some ideas have been collected. Any assistance you can provide will be greatly appreciated.—Battalion ASO

Tactical employment of the CH-47 in Southeast Asia has dictated that a crew member (gunner) be stationed at the door on the right side of the helicopter and another at the forward window on the left side. These two crew members have the dual responsibility of assisting the aircraft commander in visually clearing the helicopter and operating weapons. Although these two crew members are required to be at these stations for the performance of their duties, neither seats nor restraints have been provided.

USABAAR's position is that adequate restraint must be provided at the door on the right side of the CH-47 and at the forward window on the left side. The reasons for this position are stated in this letter. In the battalion CH-47 accidents, all fatal and nonfatal injuries were attributed to crews being unrestrained. The pilots, who were restrained, escaped injury. A company ASO stated that gunners and crew chiefs always sustained the most serious injuries in the accidents which occurred in his company. In addition, a recent USABAAR study of CH-47 accidents over a 3-year period revealed that 66 percent of all personnel injured in these accidents, including those fatally injured, were unrestrained.

The problem of insufficient or no crew restraint affects not only the user of the CH-47 but also the user of any helicopter which does not provide its crew members adequate crash injury protection. And getting the necessary restraint systems installed requires your help. Submission of EIRs is one of the most effective means for identifying problem areas, providing information for solutions and establishing the magnitude of known hazards. The old adage about the squeaking wheel and grease was never more appropriate than in this case. Unless the materiel system is jarred by numerous user complaints, it is always extremely difficult to obtain expensive modifications. Justification for funding such costly ECPs as new seats and restraint systems engineered to meet minimum safety criteria must come primarily from the field. Therefore, we recommend EIR programs be initiated and vigorously pursued.

Readers are invited to participate in this forum. Send your ideas, comments and recommendations to Director, USABAAR, ATTN: E&P Department, Fort Rucker, Alabama 36360

THE HELICOPTER: hazardous at any height?

As a sequel to CW4 Paul H. Johnson's article "Emergency Escape Systems for Helicopters" in the August issue, the following article is reprinted by permission from the October 1970 issue of U.S. NAVAL INSTITUTE PROCEEDINGS

THE HELICOPTER has proven its worth over the past decade by performing a wide range of missions in day, night, and all-weather operations. Almost daily, the news media point out instances which highlight the value of the helicopter. The news also illustrates the extreme vulnerability of the crews and passengers who become victims of helicopter accidents. Thus, while the helicopter has improved steadily from the standpoint of airworthiness and versatility, it has remained at a veritable standstill with respect to crashworthiness and occupant survivability.

In the event of a crucial inflight emergency, the helicopter's only countermeasure is its limited capability of autorotation. Very basically, this is a power-off maneuver in which the upward flow of air through the rotor system causes the blades to rotate as the helicopter descends. Just prior to touchdown, the energy of the spinning rotor system is converted into lift, as the pilot increases the collective control (rotor blade angle of attack)

cushioning the aircraft to a safe landing. In order for an autorotation to be successful the pilot must have control of the aircraft and sufficient altitude and airspeed prior to entering the autorotation. Moreover, there must be favorable atmospheric conditions such as wind and density altitude, favorable landing terrain, and sufficient visibility.

Within these stipulations—and provided that the pilot is adequately proficient—execution of this maneuver still provides only a limited degree of total helicopter/crew safety. There are at least a dozen situations not conducive to successful autorotation, many of which have directly contributed to a host of helicopter disasters. For example, freeze-up or disintegration of the gearbox, loss of a main or tail rotor blade, or loss of power at low altitude or in IFR conditions are not uncommon causes of helicopter crashes. Midair collisions and power settling (loss of sufficient rotor lift when a helicopter is settling through the turbulent air displaced by its own rotor system), though often attributed to pilot error, are recurring causes of helo losses. Major inflight fires, icing, and complete electrical failure in IFR conditions are not conducive to successful autorotation.

Probably the most important concern from the military standpoint is combat damage. The helicopter—sometimes described as "thousands of moving parts flying in close formation"—is unlike most aircraft. Not having the inherent advantage of speed or altitude in performing their missions, helicopters have the added problem of extreme vulnerability to hostile fire. Autorotation isn't the answer when control of the aircraft has been shot away!

In each of these cases where autorotation will not work, the only present escape alternative is bailout. Helicopter bailout, however, is impeded by the helicopter's basic instability, the proximity of rotor blades, and low altitude flight profiles; of five bailouts recorded by the Navy, since 1953, three resulted in fatalities. For these reasons, "chopper" crews are justifiably not required to carry or wear chutes on most missions. So it became apparent that helicopter inflight escape is at this time, for all practical purposes, nonexistent.

Paralleling these inadequate provisions for inflight escape are the helicopter's lack of safeguards against crash impact and postcrash fire. Impact-attenuating seats and crash-resistant fuel systems would greatly decrease the number of injuries and fatalities sustained in accidents occurring from low altitudes and airspeeds (i.e., from a hover). To date, however, there has been little such protection provided.

The helicopter community continuously strives to improve maintenance, design, and quality as-

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Lieutenant W. H. Baker,

Upon graduation from the U. S. Naval Academy in 1964, Lieutenant Baker proceeded to Pensacola and, after completion of helicopter training, received his wings in 1965. He was a pilot with HS-2, deploying twice to Vietnam during 1966-1969. He served as Personnel Officer, Quality Assurance Officer, and squadron test pilot while with HS-2. Presently attached as a military advisor and liaison officer for the Engineering and Advanced Systems Departments of the Naval Weapons Laboratory, Dahlgren, Virginia, he is conducting studies in helicopter survivability, and assisting in the development of a rigid-rotor, tip-jet-propelled helicopter. He is completing graduate studies with the University of Oklahoma for a Master's Degree in the field of Research and Development Management.

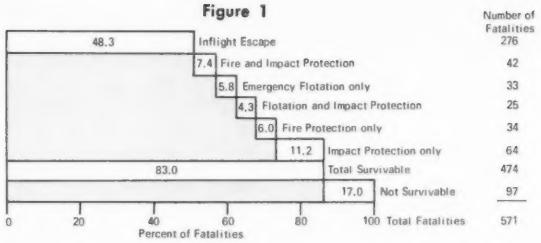
surance at every level of production and operation—as does their fixed wing counterpart. Unlike its fixed wing counterpart, however, the helicopter community has not been afforded an adequate "way out" when the need arises. Specifically, the helicopter crew has a near-zero probability of successful inflight escape as compared with about a 90 percent chance for the jet pilot. This disparity becomes grimly paradoxical upon realizing that both jets and helicopters have been operating over the same hostile territory for 10 years and that helicopters are the means by which the downed jet pilots are normally rescued.

In 1961, the U. S. Navy recognized the rapidly expanding use of "choppers" and sensed the need for a program to reduce personnel injuries and fatalities resulting from a constantly increasing number of helicopter accidents. Subsequently, accident data were collected and correlated to determine the direction in which to channel the major safety efforts. The results are significant. Figure 1 graphically indicates that a helicopter inflight escape system would decrease the number of fatalities by one half. Fire, flotation, and impact protection would further reduce the casualty rate to the point where the Navy could save close to 85 percent of those who would normally be lost in helicopter crashes. Commensurate with this large reduction in fatalities would be a proportionate reduction in disabling, major, and minor injuries.

A research and development program was set up in 1964, under cognizance of the Naval Weapons Laboratory, to develop a practical means of helicopter inflight escape. The assigned team of project engineers based its design on the concept of occupant encapsulation. In brief, the escape system, after actuation, would isolate the occupied portion of the fuselage and parachute it to safety. In little over a year the system was designed, constructed, and its feasibility proven. Five drone-configured, structurally-intact UH-25s were retrofitted with the capsule-concept system. Of five flight tests, two were invalidated owing to problems in the drone system and remote control unit (separate from the inflight escape system). Three of the helicopters, however, were sent aloft and their retrofitted capsule-escape systems remotely triggered. Each functioned perfectly, proving the feasibility of helicopter inflight escape. This indicated a revolutionary breakthrough in helicopter aviation safety (figure 2).

Upon completion of these successful feasibility tests, a Proposed Technical Approach entitled

Figure 1



Data derived from a study of 231 fatal accidents involving 571 Army and Navy fatalities suggests that an inflight escape system might have saved almost half of the victims

Helicopter Personnel Escape, Protection, and Survival (HEPS) was written by the Naval Air Systems Command in support of a program designed to eliminate the major deficiencies in overall helicopter safety. Specifically, the HEPS system would include crash-resistant fuel systems, flotation devices, redesigned seats, lightweight armor, impact-attenuation equipment, and the inflight escape capability. Depending on the type of helicopter, the latter would most likely be either a "capsule" escape system, or an upward ejection system.

To date, the operational forces have been largely unaware of these behind-the-scenes research and development efforts in their behalf. The anecdote about the doctor who was so busy with his practice that he died from a disease, the cure for which had been found a year before, has a macabre parallel in the aviators of heavily scheduled helicopter squadrons. The funding priority and future direction of the Navy's Helicopter Personnel Escape, Protection, and Survival (HEPS) program will be largely dependent on the need and support for this effort, as voiced by the helicopter pilots and unit commanders in the field.

Trade-off studies of the heavy and light-class Navy helicopters have indicated that the CH-46 and UH-1, respectively, would be the most likely existing candidates in which to install the capsule escape capability. Figure 3 schematically portrays the integration of the inflight capsule escape systems into these aircraft. Basic operation of the system includes manual or automatic initiation of the main actuating unit (figure 3, 2) which in turn transfers ballistic energy to shaped charge devices and guillotine cutters. The latter items, which are

standard equipment in present aircraft systems, sever the fuselage skin, rotor blades, wire bundles, tubing, etc. Centrifugal force carries away the rotor blades and a jettison rocket provides positive separation of the after fuselage pylon. The ultra-fast opening parachutes are automatically deployed approximately one-half second after system actuation allowing time for the blades and fuselage appendages to clear the personnel "capsule." The chutes will become fully inflated within 1½ to 2 seconds after the system is actuated. This short time interval provides for a successful operational capability from altitudes as low as 50 feet (figure 4).

Helicopter ejection escape systems have not yet been designed or tested for feasibility. With the development of zero height/zero speed capability ejection, however, it appears that such systems would be optimal for single or two-seater attack helicopters such as the AH-1G Huey Cobra. Upon actuating this type of escape system, the rotor blades would be ballistically severed after which the pilots would be ejected with a rocket assist as in normal ejection seat operation (figure 5).

Terms such as ballistic energy, rockets, and linear-shaped charges may arouse unwarranted suspicion in the minds of those who are unaware of recent strides in ballistic technology. Ballistic techniques have advanced considerably since the Chinese invented the firecracker around 3000 B.C. In recent years, ballistic initiators, rockets and linear-shaped charges have been used successfully in space capsules, ejection seats, and aircraft capsule-escape systems. In 1966, the devices were proven successful in the helicopter escape feasibility tests. In the near future, they will be incorporated in the F-14 and SH-3 aircraft. Excellent features of these specially designed ballistic systems are their safety, reliability and ease of installation and maintenance. They do not impose a fire hazard, a shrapnel threat, or an over-pressure problem for helicopter occupants. They are lightweight, compact and are not subject to HERO (Hazards of Electromagnetic Radiation to Ordnance) difficulties normal on board ship. In short, ballistic systems work and are compatible with the operational environment.

What are the odds against the escape system performance being destroyed, or the system being prematurely actuated by small arms fire or flak? Redundancy, armor shielding of crucial components such as the main actuating unit, and use of ballistic components inert against projectile hits, would minimize the odds of disabling the system performance and nullify the probability of premature actuation. Specifically, the total system reliability will be above 95 percent even after taking a good many hits. More important perhaps is the fact that HEPS would measurably reduce the odds of the crew being wounded by providing armored seats and crew shielding for aircraft operating over hostile territory.

What would happen when several helicopters are flying in formation? Would flying debris jeopardize the entire flight? In the case of automatic

The troops being transported into combat have an excellent chance of surviving the most vicious fire fight on the ground, but almost no chance of surviving if their helicopter is disabled in the air

operation, the disabled aircraft would have already jeopardized the flight prior to system actuation. In other words, it would have already thrown a blade or entered into a violent uncontrolled maneuver. Therefore, by the time the system automatically responded, other aircraft would have cleared themselves from the vicinity of the helicopter in distress. In the case of manual actuation, the flight would be forewarned of the emergency and there would be ample time to "break-off." In addition to these considerations, a built-in safety margin is provided by the horizontal and vertical separation presently prescribed in all helicopter formation flying.

In justifying the addition of a new aircraft system, its value has to override any ensuing degradation in payload or performance. The HEPS system is specified not to exceed 5 percent of the total aircraft weight. System weight necessarily imparts a degradation effect on payload, but 5 percent is likely to be an acceptable figure when stacked up against the variety of factors subsequently discussed.

The most obvious benefits to be derived from the HEPS program are the lives it will save, and the injuries it will prevent. A considerable savings of money, too, will accrue from incorporation of the HEPS proposals.

Assuming the loss of just one typical tandem-rotor helicopter with its crew, and passengers, let us look at the costs involved. It is currently estimated that the cost of training naval helicopter crews approximates $40,000 per aviator and $5,000 per crewman. Helicopter passengers such as combat troops also represent a large investment in money required for their training. A typical helicopter accident recently resulted in the loss of *six* combatants. It was estimated that in order to train an equivalent number of replacements in similar specialties, the cost would run well over $150,000. Post-accident administrative expenditures include, among other things, burial costs and payment of numerous and long-term dependent survivor benefits. The logistics involved in evacuating disabled troops and bringing in replacements is another hidden but real cost.

There are several qualitative factors which should be addressed with regard to fatal accidents in a combat environment. Loss of military experience is difficult to quantify dollar-wise, but it is logical to assume that the loss of experienced combat troops and helicopter crews will decrease the quality of a combat operation and ultimately

Figure 2

a. CH-46 Recovery Sequence b. UH-1E Recovery Sequence

affect its degree of success or failure. The basic consideration here is, that unlike an aircraft which depreciates and becomes obsolescent with time, the pilot, crewman and combat troop appreciate in value. For instance, loss of a pilot, with 5 years in service, represents a loss to the Navy not only in terms of five years of expended capital investment but also a loss in terms of the 5 years of invaluable operational and flying experience attained by the aviator. Similar qualitative rationale may be applied to battlefield operations which are seriously paralyzed by troop/reserve shortages which could have been avoided had the occupants of a helicopter crash survived. The erosion of troop and unit morale after a "helo" crash cannot be assigned a figure, but can be recognized as a degrading factor to operational effectiveness.

In most fatal helicopter crashes the majority of aircraft systems as well as the airframe itself are destroyed. The HEPS "capsule" recovery concept normally would permit recovery of valuable material portions of the aircraft such as black box electronics systems and cockpit instruments. It has been estimated that in the case of a CH-46 accident, loss of these components alone costs the Navy about $175,000.

Originally, the HEPS system was expected to be developed, qualified and incorportated in fleet helicopters during the early 1970s. The recent funding cuts, however, have clouded the future of the program and raised three basic and alternative questions regarding its outcome. Shall the HEPS program be cancelled? Shall the program be continued on a research and development level with the goal of incorporating the systems into future helicopters? Shall the program be given the go ahead to develop a HEPS system for incorporation into existing operational helicopters?

To accept the first alternative of cancellation would be to ignore the accident statistics and disregard the obvious need for improved helicopter crew safety. It would also necessitate acceptance

of the losses previously examined and be a departure from a traditional philosophy to improve the odds of pilot and crew survival whenever practicable. To follow the second course of gearing the program to future helicopters would again be ignoring the existing needs and in effect wasting the in-house technical expertise which has recently been acquired. Presently, the Navy has requirements for newly designed operational helicopters, but it will be some time before these requirements materialize into Fleet hardware. Therefore, to revert to a research and development effort to design and develop a helicopter escape system for a nonexistent helicopter would be a doubtful undertaking. A more fruitful endeavor might be to set down basic requirements ensuring that future military helicopters are in fact designed with integral and adequate escape and survival systems.

It has been suggested that the best path to follow would be that of the third alternative, to develop a system for existing helicopters. In effect it would require that prompt action be taken to retrofit the present applicable helicopters—if not with the goal of incorporating all of the HEPS proposals, then at least with the goal of phasing in those features which would provide the maximum return for the money available.

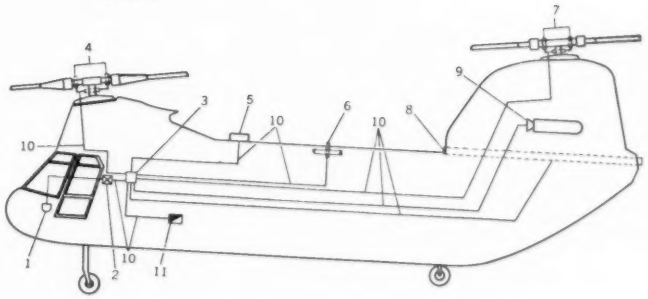
Retrofit is a rather common method of updating and modernizing Fleet aircraft. It is also a technique which deserves careful consideration in determining why and how it should be accomplished. There are four basic factors supporting a decision to ratrofit the HEPS system into existing aircraft. The first is that the need for HEPS in present helicopters exists now and will continue to exist for at least 10 years to come. The second is that a relatively low risk is involved in developing an operational HEPS system. It is recognized that the state-of-the-art weighs heavily in deciding where money should be spent with regard to the many programs funded by the Department of Defense. Most of the HEPS proposals have been within the state-of-the art for several years and therefore could be introduced into the Fleet in a relatively short period of time. The third factor supporting a retrofit program is that the successful 1966 HEPS flight tests conform well with the "fly before you buy" concept being adhered to by

CH-46

1. Pilot's "D" Ring
2. Ballistic Initiator and Safe & Arm Device (Main Actuating Unit)
3. Distribution Manifold
4. Rotor Blades and Hub (Fwd) Severing Device
5. Parachute Initiator (UFOP System)
6. Transmission Shaft Severing Device
7. Rotor Blades and Hub (Aft) Severing Device
8. Engine Pylon and Structure (Aft) Severing Device
9. Engine Pylon and Structure (Aft) Eject Rockets (2)
10. CDC Lines (Confined Detonating Cord)
11. Ballistic Devices for Severing the Hydraulic Tubing, Control Cables and Electrical Wiring

Actuation of Pilot's "D" Ring Cocks and Fires the Ballistic Initiator. Energy is Transmitted Through the CDC System

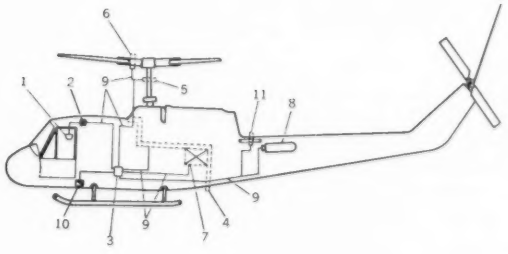
Figure 3



UH-1

1. Pilot's "D" Ring
2. Ballistic Initiator and Safe & Arm Device (Main Actuating Unit)
3. Distribution Manifold
4. Fuselage Severing Device (FLSC)
5. Transmission Shaft Severing Device
6. Rotor Blade and Hub Severing Device
7. Parachute Initiator (UFOP System)
8. Aft Fuselage Eject Rockets (2)
9. CDC Lines (Confined Detonating Cord)
10. Ballistic Devices for Severing the Hydraulic Tubing, Control Cables and Electrical Wiring
11. Transmission Shaft Severing Device

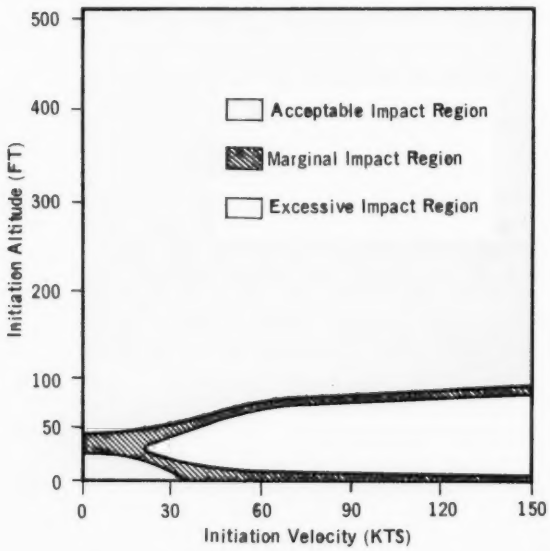
Actuation of Pilot's "D" Ring Cocks and Fires the Ballistic Initiator. Energy is Transmitted Through the CDC System



Department of Defense managers in planning, programming, and budgeting. The fourth factor is that the program could be carried out as a joint-service effort thereby gaining advantage from a cost-effectiveness standpoint.

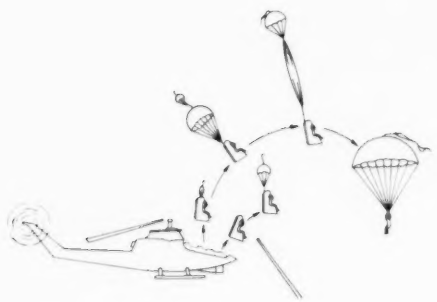
The latter statement deserves closer attention. Presently the Navy's helicopter inventory includes approximately 450 CH-46s and 200 UH-1s. The Army has approximately 500 CH-47s (similar configuration to CH-46) and 4,500 UH-1s. Each service is using and procuring sizeable numbers of the two-seater AH-1G attack ships. Both of the services have experienced unacceptable losses owing to helicopter accidents and have the same basic requirements to reduce these losses. At present, the Navy has built up a well-rounded body of technical knowledge with respect to helicopter inflight escape systems, lightweight armor, flotation techniques and impact attenuation methods. The Army, on the other hand, has compiled a storehouse of knowledge with respect to helicopter vulnerability against hostile fire, crew vulnerability in crashes, and crash-resistant fuel systems. Since both services do have common aircraft, similar requirements and technical expertise in particular areas, it follows that a joint-service effort, relying on combined in-house technical competence and management, offers the logical and efficient path in pursuing a program to upgrade helicopter survivability on a broad scale. HEPS forms the working foundation for such an endeavor.

Figure 4



Survivability curves are based on inflight escape from a CH-46 in straight and level flight

Figure 5

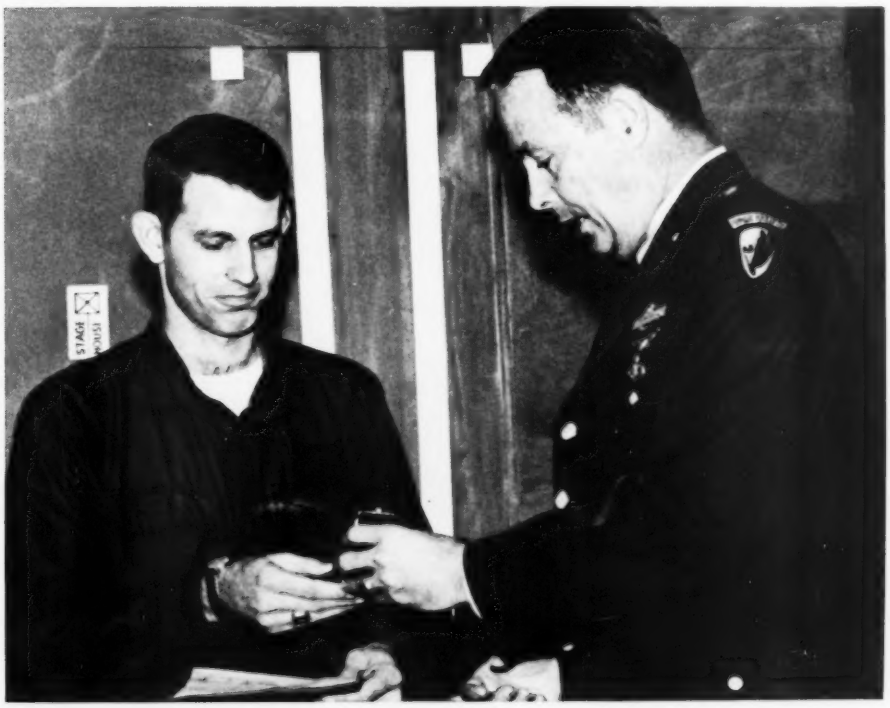


Although HEPS cost figures are not presently available for publication, it has been determined that the projected dollar savings provided by HEPS more than offset the costs of developing and incorporating the systems into all applicable helicopters. The simplistic attitude toward helicopter safety has been to "prevent accidents." A realistic response to this panacea phrase is "Okay, but we'll have to stop flying."

Accident prevention is certainly a primary responsibility in each stage of design, production, training and operation. The fact is that the helicopter is a vehicle which is continuously being assigned an expanding variety of missions. The fact is that helicopter crews are presently not afforded even a meager chance of survival against crucial inflight emergency or subsequent crashes. The fact is that unless we do stop flying, accident history will repeat itself in a predictable manner based on past statistics. The HEPS program recognizes these facts and addresses the reality of future accidents by providing logical and realistic countermeasures to minimize the losses which these accidents would incur. It provides the Navy (and could provide the Army) with a sound investment program which would pay off through increased operational effectiveness and through a tremendous savings in men, money, and materiel. HEPS finally provides a compatible framework on which to construct a profitable joint-service endeavor to do away with the unacceptable and, for the most part, unnecessary losses resulting from helicopter accidents.

BROKEN WING AWARD

FORT RUCKER, ALABAMA—CW2 James T. Miller (left) and Captain Lawrence J. Gilbert received Army Aviation Broken Wing Awards in recent ceremonies. Both pilots successfully landed their OH-58s after engine failures. CPT Gilbert was on a training mission at Ft. Rucker and CW2 Miller was on a combat flight in the Republic of Vietnam. CW2 Miller's parents are Mr. and Mrs. Theron W. Miller of Mount Clemens, Michigan, and CPT Gilbert is the son of Mr. and Mrs. Lawrence V. Gilbert of St. Louis, Missouri.



FORT WOLTERS, TEXAS—Captain Charles R. Stutzman (left) was presented the Army Aviation Broken Wing Award by Brigadier General R. N. Mackinnon, commandant of the Army Primary Helicopter School. CPT Stutzman, IP, was on a TH-55 night training mission when electrical failure and fire occurred, accompanied by partial power loss. Sparks emitted from the console and dense smoke filled the cockpit. CPT Stutzman shut off all electrical switches and increased air speed for a fast approach to a stagefield. Engine rpm became erratic and he initiated an autorotative descent. Unable to reach the stagefield, he changed his heading toward a poorly lighted road and flared at what he thought was the correct altitude. He completed the landing with only incident damage to the fore and aft crossbeams. CPT Stutzman is the son of Mr. and Mrs. Charles V. Stutzman, League City, Texas.

Learning from the mistakes of others can be an excellent source of knowledge. However, some pilots don't believe they can learn this way . . . they think they know it all

I'VE BEEN ON the other side of the fence when safety was a topic in monthly meetings or a poster on the bulletin board. While I was assigned to operational units, the other pilots and I really didn't have much to do with safety. Oh, we put up with the safety officer. We became deeply concerned when an aircraft from our unit was involved in an accident or when a buddy's wife

Major Edwin R. Widmer
Aircraft Accident Analysis and Investigation Dept.
USABAAR

became a widow. But when I was required to write a safety SOP or directive, or required to attend mandatory safety meetings, I thought: "This safety business is a drag!" All those rules and regulations were a pain and I thought flying would be much more enjoyable and relaxing if they would do away with all that safety nonsense, with its rules and regulations.

Now, after several years, and after being assigned to USABAAR, I can look back and see how terribly wrong I was. Now, safety is everything. To be effective here at USABAAR you must live, breathe and project safety to others on a daily basis. A big part of my job consists of reviewing accident reports on a daily basis. It's depressing to review reports where people are

Unauthorized low level flight cost two lives and a destroyed helicopter

A decision to attempt to return to the base airfield after the loss of transmission oil pressure resulted in 11 fatalities and destruction of this UH-1H

injured and killed because of careless or stupid mistakes. Repetition soon becomes evident. The same mistakes show up time and time again and they are killers.

I ask myself why. Don't people ever learn? What can be done to end this waste of manpower and materiel? Answers to these questions are not simple. Yes, people do learn. We learn fast if we want to and if the topic is of prime interest. Learning from the mistakes of others can be an excellent source of knowledge and can save us from learning the hard way, through similar accidents. However, some aviators don't believe they can learn from the mistakes of others. They think they know it all. A flight surgeon's comments from a recent accident vividly illustrates this point:

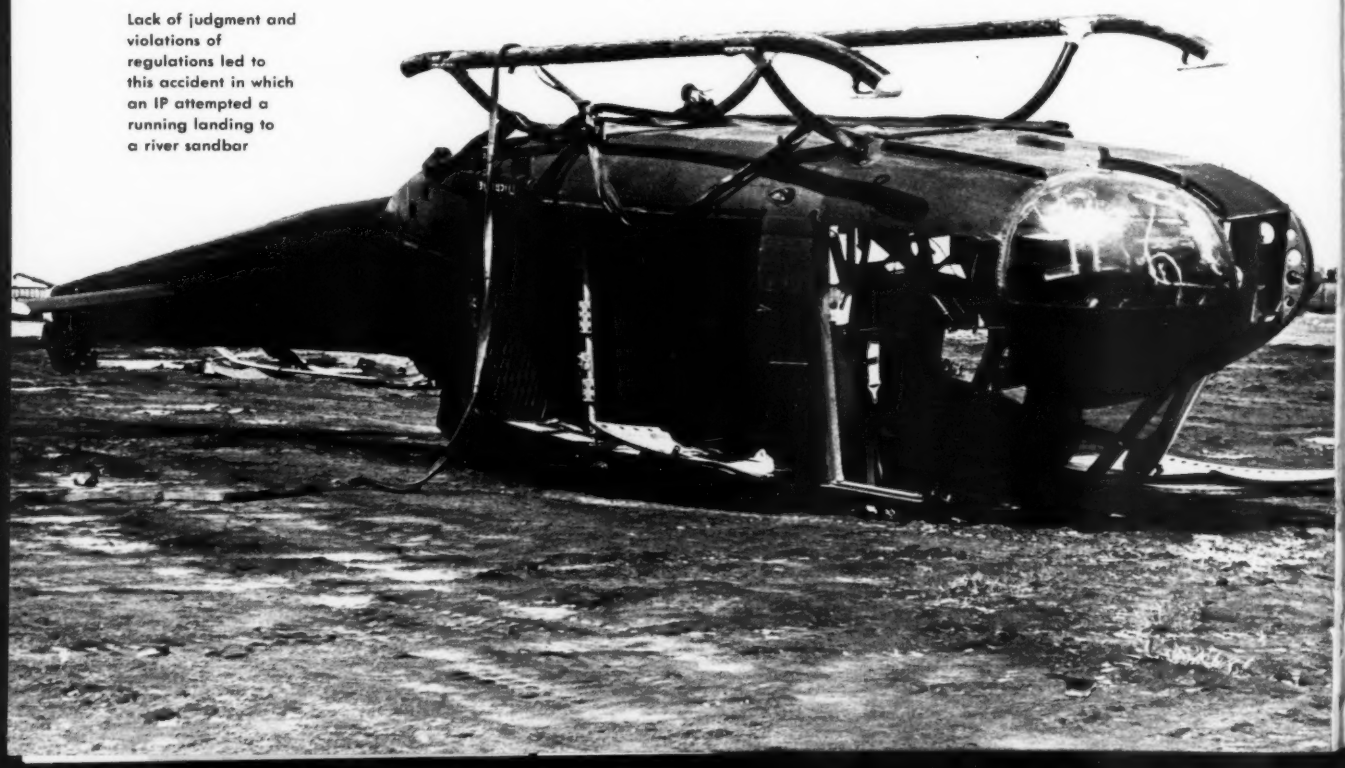
"Most aviators at one time or another develop the feeling that they have reached the point where they feel qualified to handle any situation that comes along, whether or not they are actually qualified in that area. With it goes the feeling that all those accidents that happen to others could never happen to them. It usually takes a 'close call' to reorient them toward the safety manuals. Some are not so fortunate."

Ignorance plays a villain's role. Ignorance of the results of careless operations and defiance of well-founded rules and regulations will get you almost every time. Is it worth the risk when everything is stacked against you? There are several answers about what can be done. I consider education of prime importance—getting the word out. It's up to each individual to develop the proper attitude about safety. You have to go out and become a believer yourself. No one else can do it for you.

We have heard, over and over, *accomplish the mission* described as our foremost objective. I submit that safety must be a parallel objective. What good does it do to rescue a wounded man from the jungle, then kill him in an accident on the way to medical aid?

As you read about the following accidents and look at the photographs of torn up aircraft, I hope you will be convinced of the necessity for learning from the mistakes of others. Make a positive determination that you will not permit these mistakes to be yours.

A UH-1H was on a reconnaissance team mission. After 25 minutes of flight, half way through the mission, the aircraft commander reported a loss of transmission oil pressure and said he intended to fly to the base airfield approximately 10 kilometers away. About 2 minutes later, a distress call was transmitted. The helicopter entered a gradual right descending turn, then entered a spin, during which the main rotor blades were seen to slow down. At approximately 400-700 feet agl, the main rotor stopped and the helicopter entered a flat spin, impacting nose low in a left bank. Fire



Lack of judgment and violations of regulations led to this accident in which an IP attempted a running landing to a river sandbar

broke out and consumed most of the wreckage. There were 11 fatalities.

Many cause factors were involved in this accident. However, a significant factor was reported as materiel failure. The loss of transmission oil pressure precipitated transmission failure. More significant, though, is an operational factor. The aircraft commander elected to fly to a secure airfield rather than make an immediate precautionary landing. Adequate security, in the form of infantry troops aboard the aircraft, was available to him. The operators manual for this helicopter specifically states it should be immediately landed under these circumstances. Why didn't this aircraft commander land when his instruments told him something was wrong? Did he feel a precautionary landing in a combat zone would be hazardous? Didn't he believe his instruments? We'll never know. We do know, however, that he made the wrong decision—a fatal mistake.

A UH-1D strike accident resulted from an unauthorized, unnecessary and foolish low level flight. Two pilots were returning from a training flight conducted with another helicopter. The pilot of the lead helicopter announced over the radio that he was going to fly low level. He struck wires, then trees, and the helicopter crashed and burned, killing both pilots. This pilot's irresponsibility, disregard for established procedures and his decision to violate regulations cost him his life and the life of his copilot.

With his windshield covered by condensation, the aircraft commander of a UH-1H decided to hover rearward out of a parallel revetment since he could not see to the front. While hovering, he asked the crew chief to check his clearance to the rear. The crew chief replied that there was another row of revetments behind them. He was then instructed to keep the aircraft commander cleared from obstructions. A few seconds later, the tail boom hit the revetment in which another UH-1 was parked. Both main rotor blades of the hovering UH-1H struck the parked UH-1. The aircraft commander made a hovering autorotation. Fortunately, there were no injuries. Damages to the hovering UH-1H were $121,800. Though considerable, as apparent in the accompanying photograph, dollar damages to the parked UH-1 are unknown. The established cause factor was listed as the aircraft commander's failure to remove or have the condensation removed from the windshield. Also, he failed to use a ground guide.

While conducting a 90-day standardization ride, the IP of a UH-1H decided to demonstrate a simulated antitorque failure by making a running landing to a smooth sandbar in a river. As he approached the termination, the nose of the helicopter swung right and he attempted to go around. The skids contacted the sand, slid, and the right skid buried in the sand, causing the helicopter to roll over. The main rotor and transmission separated, as did the tail rotor and 90-degree gearbox. Both pilots escaped injury, but the helicopter was a total loss. The established cause factor was listed as operational, with a probable or suspected factor of training. The IP realized the area was not suitable for an actual running landing. His ability to recover safely was overshadowed by his lack of good judgrent. He also violated unit, battalion and higher command regulations.

These are but a few examples of the types of repeated mistakes and obvious decision errors which cost lives, equipment and dollars. While they all involved helicopters, similar examples involve airplanes.

It's easy to sit back and analyze an accident *after* it happens by saying this or that should not have or have been done. Effective prevention, however, must come *before* accidents happen. Each aviator must resolve that he will not repeat the previous mistakes of others and that he will not be responsible for losses of lives and equipment.

We should all ask: "What can I do to be sure I am not involved in an aircraft accident?" The answer is not simple, but I offer the following suggestions:

- The first step is awareness that you are operating a potentially dangerous machine. Respect it, operate it within its designed parameters and it will serve you well.
- Admit that you are human and prone to error. Allow for and count on human errors. Establish a system of checking and rechecking.
- Avoid complacency in yourself and look for it in others.
- Adhere to published safety directives and regulations. They are published for sound reasons, chiefly to ensure safe operations.
- Be professional in your individual duties, whether you are a crew chief, gunner or aircraft commander. Employ the principles of sound airmanship.

As pointed out, each of us should read, listen and heed. Learn from the mistakes of others and live to a ripe old age. It's highly unlikely that you will learn or discover a new way to crash. If you think you have a new one, check it out. I'll give you 10 to 1 odds it's been tried before. Remember—heads you win!

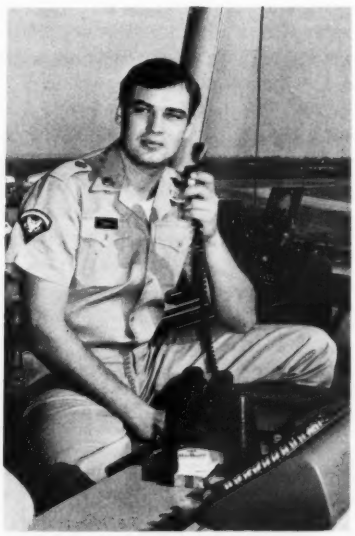
USAASO Sez

The U. S. Army Aeronautical Services Office discusses

Well Done—SP5 John T. Eubanks

Airfield operations guide

Aviators: check your VOR receiver



Specialist 5 John T. Eubanks

Well done: Somewhere in the recesses of most aviators' subconscious lingers that haunting fear of that accident, the cause of which will be documented as "PILOT ERROR." No one likes to be held up for ridicule by his peers, but where else can the finger be pointed when a pilot puts a beautiful shiny bird on an unrelenting surface—with the wheels nestled snugly in the wells?

One more aviator still walks erect with his head held high because of the professional, dedicated manner in which Specialist 5 John T. Eubanks does his thing as an air traffic controller in Cairns control tower at Cairns AAF, Ft. Rucker, Ala. During a very busy, hectic training period in which SP5 Eubanks' attention was demanded in all quadrants, he noticed that the wheels were still up on a U-21 on a short final and was able to warn the pilot in time to avert a serious accident. To SP5 Eubanks, USAASO sez WELL DONE!

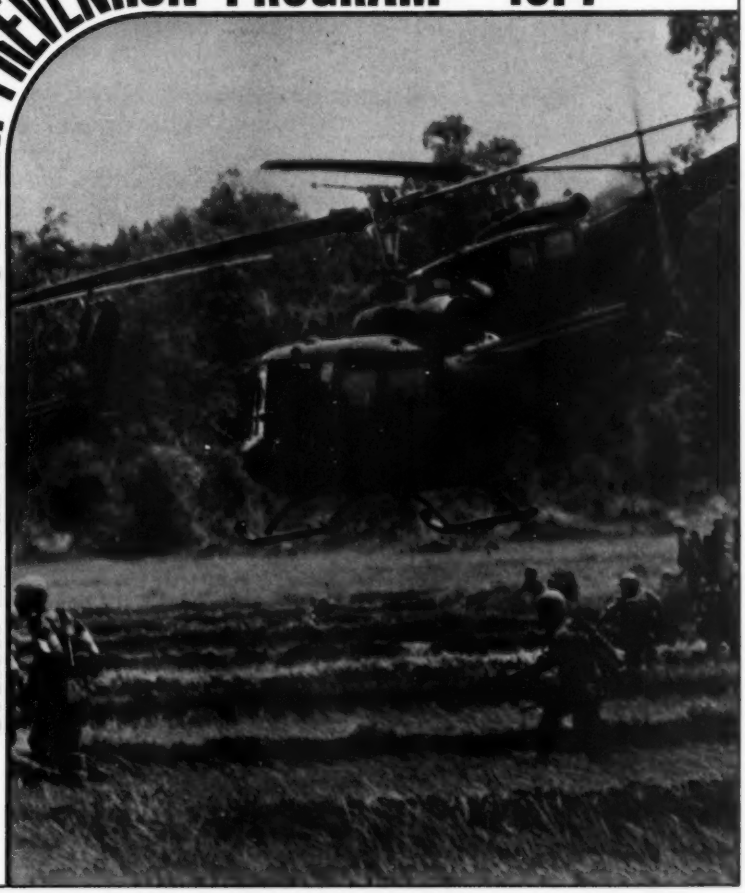
Airfield Commander—Now Hear This: Is your airfield running you or are you running the airfield? Do you need a thingamajig? Do you know how to obtain one each thingamajig? A recent publication authored by USAASO is a condensed reference guide to almost every problem encountered at an AAF. What is this miracle of miracles called? It's the "Guide for the Operation of Army Airfields," DA Pamphlet 95-15, dated December 1970. If perhaps a problem or two arises on which the pamphlet fails to help, be sure to send your recommended changes to the U. S. Army Aviation School as stated in paragraph 1-3b of the pamphlet.

Check Your VOR Receiver: The importance of determining the accuracy of airborne VOR equipment prior to flight cannot be overemphasized. This is especially important for planned IFR operations as the national airspace system depends on VOR airways. A properly operating VOR receiver will enable you to navigate accurately; remain within assigned airspace on approaches and in holding patterns; avoid obstructions when utilizing the VOR to identify a step-down fix; ensure traffic separation when fix accuracy and distance factors are involved.

Paragraph 91.25, FAR 91, spells out several methods of determining VOR receiver accuracy. The DOD FLIP, section II, outlines VOR tolerances and lists ground and airborne checkpoints. The IFR and VFR Supplements also list the VOT test facility frequencies in the radio aids to navigation section. If in doubt as to methods of tolerances for VOR receiver check, contact your unit standardization pilot or instrument examiner. Do not rely on instruments that exceed standard tolerances. The airspace is daily becoming more crowded; be sure the portion you use is where you should be and the air traffic controller expects you to be.

USABAAR THE U. S. ARMY BOARD FOR AVIATION ACCIDENT RESEARCH, FT. RUCKER, AL.

SAMPLE AVIATION ACCIDENT PREVENTION PROGRAM - 1971



This sample prevention program was compiled from prevention programs submitted by units throughout the Army. It is designed to provide the basic elements for organizing a program to prevent aviation mishaps and conserve resources without compromising mission requirements. Copies may be obtained by writing to: *Director, USABAAR, ATTN: E&P, Fort Rucker, Alabama 36360. Please note this sample program is a guide ONLY. When extracts are used, they must be fitted to each unit's environmental and operational requirements.

Direct communication authorized by AR 15-76

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